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A SERIES OF TEXTBOOKS FOR PERSONS ENGAGED IN ENGINEERING PROFESSIONS, TRADES, AND VOCATIONAL OCCUPATIONS OR FOR THOSE WHO DESIRE INFORMATION CONCERNING THEM. FULLY ILLUSTRATED

ORNAMENTAL METAL WORK CONTRACTS

SCRANTON
INTERNATIONAL TEXTBOOK COMPANY
1924

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Press of
International Textbook Company
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PREFACE

The volumes of the International Library of Technology are made up of Instruction Papers, or Sections, comprising the various courses of instruction for students of the International Correspondence Schools. The original manuscripts are prepared by persons thoroughly qualified both technically and by experience to write with authority, and in many cases they are regularly employed elsewhere in practical work as experts. The manuscripts are then carefully edited to make them suitable for correspondence instruction. The Instruction Papers are written clearly and in the simplest language possible, so as to make them readily understood by all students. Necessary technical expressions are clearly explained when introduced.

The great majority of our students wish to prepare themselves for advancement in their vocations or to qualify for more congenial occupations. Usually they are employed and able to devote only a few hours a day to study. Therefore every effort must be made to give them practical and accurate information in clear and concise form and to make this information include all of the essentials but none of the non-essentials. To make the text clear, illustrations are used freely. These illustrations are especially made by our own Illustrating Department in order to adapt them fully to the requirements of the text.

In the table of contents that immediately follows are given the titles of the Sections included in this volume, and under each title are listed the main topics discussed. At the end of the volume will be found a complete index, so that any subject treated can be quickly found.

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ORNAMENTAL METAL WORK
(PART 1)

CAST-IRON WORK

INTRODUCTION

1. Iron is used in building construction to serve two purposes, one structural and the other ornamental; but becomes an element of architectural consideration only when both purposes are combined. Unfortunately, the facility with which iron may be cast or wrought into any desired form renders the execution of the whole façade of a building as simple as though it were constructed of wood, and imbues the ironwork designer with a tendency to ignore the characteristics of the material with which he is working, and to execute columns, capitals, and friezes in cast iron with fidelity to original examples that were carved in stone and whose designs are ill suited to iron.

However, the incombustible character of this material, and the fact that its use materially shortens the time and decreases the expense of erecting a building, render it certain that iron as a building material is as important in the 20th century as was stone before the Christian era; and instead of condemning it as an "unarchitectural material," as some are inclined to do, it is our duty to study its character and possibilities in design and to develop a system or scheme of design that will be consistent with the conditions imposed by the material and its structural use.

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To do this, it will be necessary to understand the method of manufacture and difficulties attendant on the execution of any design in ironwork, so that in preparing a design it can be kept free from impossible demands. For instance, if the design is for a piece of cast-iron work, the designer must provide a means of molding the form properly and of getting the fluid metal into the mold without injuring any of the finer details. If the design is for a piece of wrought-iron work, such as a grille or a railing, provision must be made for enough space to permit riveting, hand welding, etc.

Thus, it will be seen that a careful consideration of the methods used in general shop practice will be the best way for the ironwork designer to advance in the comprehension of his work. This Section will therefore treat of the details of shop and field work in connection with the manufacture of iron for architectural purposes; and, therefore, the illustrations of working drawings used herein to elucidate the text are reproductions of drawings that have actually been used in the preparation of ironwork for some of the most important buildings in the United States.

Within certain limits, all that is necessary to know in regard to patternmaking and molding will be indicated in a general way; but, as in all other industries, new methods are constantly being adopted in working out the details of the various problems as they arise, although the basis of the operations remains the same.

METHOD OF MANUFACTURE

DEFINITIONS OF TERMS

2. Cast Iron.—The material obtained by melting iron ore with coke in a furnace is called *pig iron*. When the latter material is remelted and poured into a suitable receptacle, or *mold*, and allowed to cool and solidify, it constitutes **cast iron**. Cast iron is hard, brittle, and somewhat crystalline in its composition—that is, it shows on its fractured

surfaces an appearance resembling an aggregation of small crystals, instead of a fibrous fracture like wrought iron. It is used, architecturally, for columns and newel posts, and, under certain conditions, for lintels or beams; but, owing to its lack of tensile strength, it is not well adapted to conditions of transverse strain. Cast iron is also formed into slabs for the purpose of stair treads, pavements, etc., and some forms of ornament are cast and attached to structural details.

3. Molds are the receptacles into which the molten metal is poured to give it some definite form consistent with the purpose that cast iron is to serve in the building. The molds are made by impressing in sand a cavity or a number of cavities that correspond in shape and relation of parts with the contour of the object to be cast. The process of so impressing the sand is called *molding*, and is effected by means of a wooden, plaster, or metal model of the object, called a *pattern*, which is so embedded in the sand that it will leave its impress when withdrawn.

4. Cores, as the word implies, are those parts of the mold that form the inside of hollow castings, and also means any parts of the sand mold that are made separately and placed within the principal mold. They are made of a mixture of sand and flour, or oil, and with the exception of very small cores, they are usually stiffened by running an iron bar lengthwise through their middle.

5. Casting is the operation of pouring the molten iron through the inlets—or *gates*, as they are called—into the sand mold from which the pattern has been withdrawn. All of the details just described culminate in the casting. The making of the pattern, with its allowances for shrinkage and draft, the preparation of the mold with its gates, and all the details attendant thereon, are for the sole purpose of securing a perfect casting, and all conditions and contingencies must be considered before the metal is poured.

6. Patterns are generally made of wood or of plaster, and occasionally partly of each. Where there are to be a

great many castings of one kind, the pattern is sometimes made of bronze or iron, in order to withstand the wear, but even in such cases the bronze or iron pattern would be cast in a mold originally impressed with a wooden or plaster model. Whether a pattern shall be of wood or plaster depends entirely on the character of the work. Patterns for plain straight work, such as molded panels, stair strings, columns, etc., are generally made of wood; but ornamented moldings, decorated panels, complicated capitals, etc. are first modeled in clay or wax, from which a cast is taken in plaster.

All patterns must have an allowance made for *shrinkage;* that is, the contraction and consequent decrease in size that every casting undergoes in the process of cooling. In ordinary work, this amounts to about $\frac{1}{8}$ inch per foot in every direction; so that the patternmaker should use a *shrinkage rule* to lay out his work.

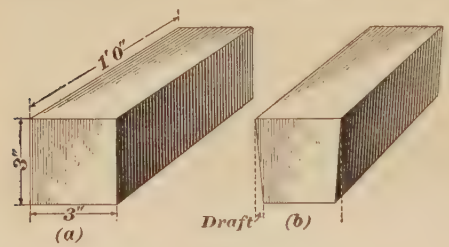


FIG. 1

The shrinkage rule is usually a little over 2 feet in length and the divisions on it corresponding to 1 foot are in reality 1 foot and $\frac{1}{8}$ inch, and the subdivisions are proportionately excessive. Consequently, the pattern for a cast-iron bar 1 foot long, 3 inches wide, and $1\frac{1}{2}$ inches thick, would measure 1 foot $\frac{1}{8}$ inch long, $3\frac{3}{16}$ inches wide, and $1\frac{3}{16}$ inches thick.

In order that they may be freely withdrawn from the mold, patterns are worked with a *draft*, or taper. For example, if the object to be cast is a solid bar 1 foot long and 3 inches square in section, as in Fig. 1 (*a*), it will be found, in lifting the pattern from the mold, that the sand has a tendency to cling to the sides and thus destroy the mold; but if the sides of the pattern are slightly beveled, as in (*b*), this tendency will be overcome, and the sides of the mold will be left clean and sharp. Therefore, in every case where it is possible, all surfaces that occupy a vertical position in

the mold should have an allowance for draft. The exact amount of this allowance cannot be given, for in some cases there should be as little as possible, while in others it may be quite considerable without in any way impairing either the purpose or the appearance of the part.

7. Undercut work is the term used to describe the shape of any part or parts of the pattern that cannot be removed from the sand without special arrangements being made for that purpose. Whether any member is to be considered as undercut or not sometimes depends on the position of the pattern in the mold.

A casting of the shape and section shown in Fig. 2 (*a*) and (*b*) is not considered undercut, if it is molded vertically,

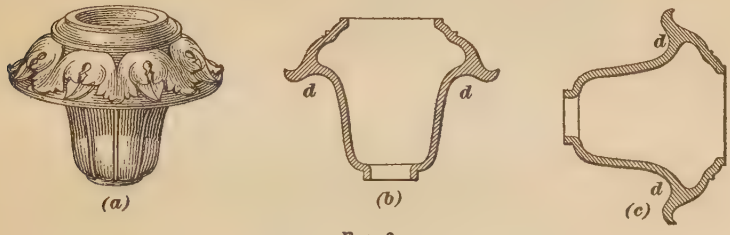


FIG. 2

as here shown and as explained later, but if for any reason this same article should have to be molded in a horizontal position, as in (*c*), the hollows *d* would then make it undercut, as the pattern could not be removed from the mold without carrying away the sand held in the hollows.

8. Modeling and Templet Work.—Sometimes it becomes necessary to make the whole or part of a pattern in clay or wax. Such molding is done by hand, and some of the tools used for this purpose are shown in Fig. 3.

When the molded parts constitute plane or circular surfaces, the hand work may be made less difficult by means of templets, mostly in connection with molds in plaster of Paris. This is largely done by drawing templets over the plaster while in a soft condition. These templets are usually made of thin plates of zinc that are cut out to the shape of the molding

or whatever is to be formed in plaster. To strengthen and keep the templets from bending, they are backed with wood.

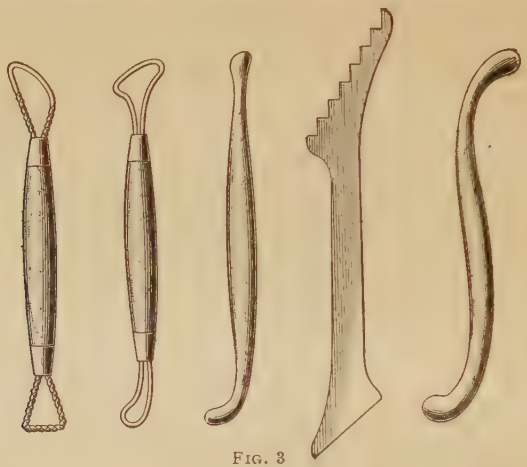


FIG. 3

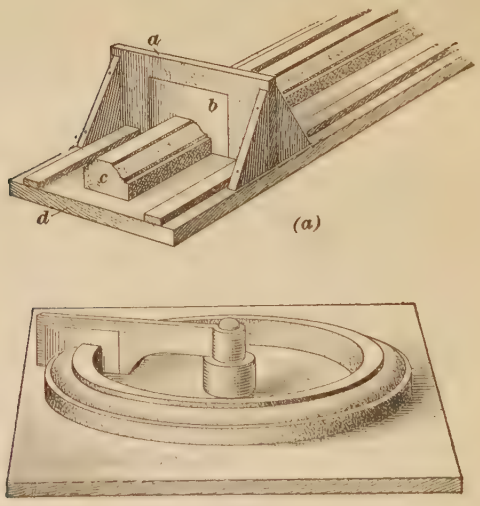


FIG. 4

Fig. 4 (*a*) shows a templet *a* with the zinc part *b* resting on a board *d*. The plaster molding that has to be run up is shown at *c*.

If the molding is required in the shape of a ring, the operation is similar, but the templet is worked from a central pivot, as shown in Fig. 4 (*b*).

9. Shell Patterns.—If the casting is to be made of thin metal, the pattern, which is called a **shell pattern,** is made on a supporting block or bed, sometimes called a *match.* The match, shown in Fig. 5, is made of plaster of Paris *a* and a wooden frame *c*, the latter being used simply to protect the plaster of Paris. The inside of the pattern, which is made of plaster, is shaped on the match with a zinc templet. After becoming hard, the plaster is oiled and varnished, so that the pattern will not adhere while being made. More plaster is

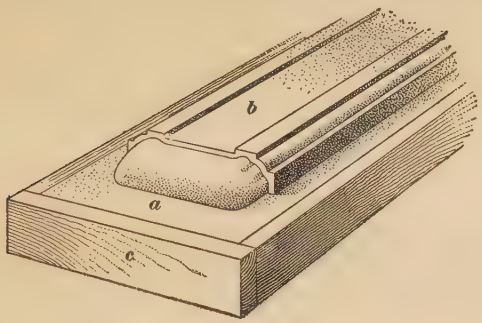


Fig. 5

then applied and this is swept with another templet made to conform with the outside of the pattern, which completes the model, as shown at *b*. The pattern is then allowed to remain until it has hardened, after which it is removed.

The match is also used in place of a follow board when a pattern is being rammed in the mold. A pattern, as shown, might possibly be part of the trim around an entrance, in which case the ends would be cut and mitered to form the corners in the same manner as a wooden casing.

10. Patternmaking.—Before describing the process of molding, it is necessary to know more about how patterns are made. A few typical examples will illustrate this in a general way. When the object is of a flat nature, such as a panel or fascia, Fig. 6, the pattern may be either of wood or of plaster.

If there is any ornamental work, as at *a*, the decoration is modeled in clay or wax and then planted on the pattern.

FIG. 6

If the casting is to be hollow, as, for example, the newel post or short column with open ends, shown in Fig. 7, the pattern might be a shell in two halves, joined diagonally and supplemented by a *core box* with which to mold the sand core in order to form the hollow in the finished casting. The making of core boxes will be described further on. In this case, it is assumed that the decoration is in low relief and not undercut. In making this pattern, the body of one-half would be made of wood or plaster and the modeled ornament planted on. From this original pattern, the halves are molded in plaster and used as the working pattern.

FIG. 7

11. Molding.—The making of molds of various shapes into which molten metal is poured to form different objects is termed **molding.**

The tools used for molding are shown in Fig. 8, and include the rammer with which the sand is pounded into the box and several other implements that are employed to smooth and finish the sand after the pattern is removed. The names of these implements are given in the illustration.

The boxes containing the molds, called *flasks*, are made of either wood or iron. In cases where great numbers of

similar castings are to be made, iron boxes are preferable. Fig. 9 illustrates an ordinary iron box with toothed cross-ribs, to bind the sand and prevent it from dropping out by its own

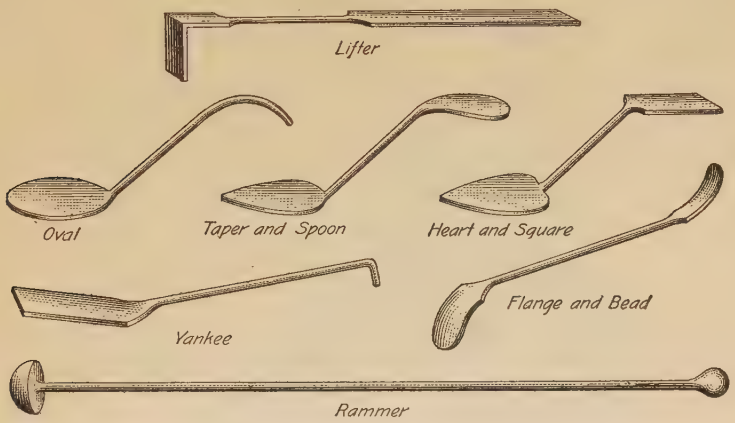


FIG. 8

weight. The pins c, fastened to lugs d_1 on the lower half b, fit into holes in lugs d_2 on the upper half a, thus fixing the relative position of the two halves. When the mold is complete, the two parts are held together with clamps.

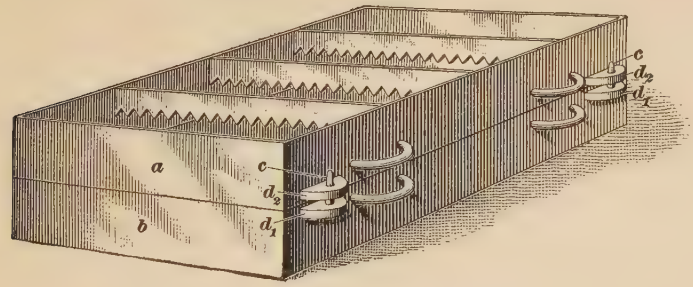


FIG. 9

12. Examples of Molding.—The method of molding a flat panel or fascia, which is shown in Fig. 6, is as follows: The pattern to be molded is first laid face upwards on a board, known as a *follow board*, and then half of the flask, called the *drag*, is placed over the pattern and securely

clamped to the board. Sand is then put into the box and firmly tamped down all around the pattern, as in Fig. 10 (*a*). Both box and board are then turned over, as shown in Fig. 10 (*b*), and the board is removed, leaving the pattern uncovered, after which a special dry sand, known as *parting sand*, is sprinkled over the face of the mold. The upper half of the flask, called the *cope*, is now clamped on top and sand

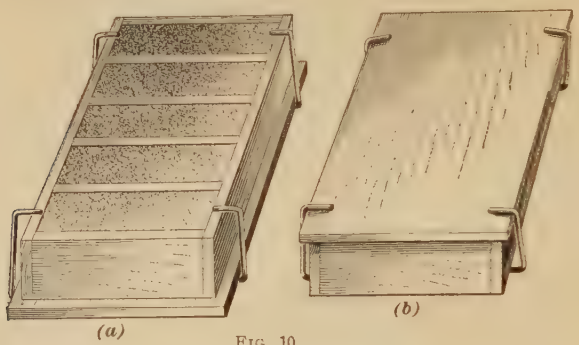


FIG. 10

is filled in as before, but this time two or more tapered wooden plugs are put in, extending from the pattern to the top of the cope. After the mold is made, these plugs are withdrawn, and the cavities that result make gates and risers for the metal. The top part of the box is next removed and the pattern is withdrawn, leaving an impression of its face in the drag and its back in the cope. The use of

FIG. 11

parting sand makes the mold separate evenly between the cope and the drag, without disturbing the casting sand.

When a mold is made in the manner just described, there will perhaps be very little finishing to do, but if the sand impressions need any smoothing or alterations, it should be done at this point. The gates or channels for the passage of molten metal are then formed by pulling out the plugs

already mentioned. When the metal is poured into the box, it fills not only the space previously occupied by the pattern, but the gates or risers also. The casting will therefore appear as shown in Fig. 11. The gates *a*, *a* are knocked off with a blow from a hammer, after which the casting is cleaned.

13. In Fig. 12, the newel post is hollow and with ornament in low relief. Except in minor detail, the process of casting is the same as that just described. One-half of the

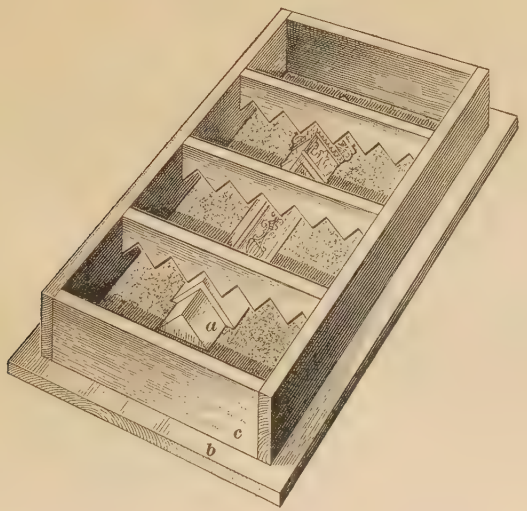


FIG. 12

pattern is laid on a board, as shown at *a*, and one-half of the molding box *c* is laid over the pattern and on the board *b*. Sand is rammed tightly all around and over the pattern, and the mold is then turned upside down. The board *b* is now removed, and the other half of the pattern is laid in place. The upper part of the molding box is then placed over the lower part and filled with sand around the upper half of the pattern, as before. The top part of the mold is now lifted off and the pattern withdrawn, leaving half of the mold, as shown in Fig. 13 (*b*); but, as the casting is to be hollow, a core will be necessary to form the cavity. This core

consists of a block, or bar, of sand the size and shape of the hollow portion, or inside of the casting, as shown at *d*, Fig. 13 (*a*). The core is supported at each end in recesses *g*, Fig. 13 (*b*), formed for the purpose by projections on the pattern called *core prints*. When the core *d* is in place, resting on ends *e*, *e*, the recess *f* shows the thickness the metal will be when the newel is cast. The mold is now ready for casting, if gates have been provided and small holes, called vents, have been left through which the gases may escape.

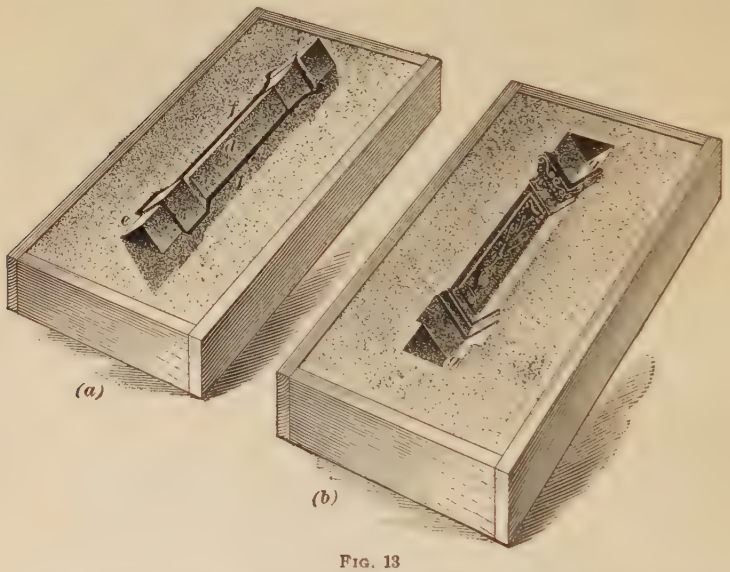


FIG. 13

These gases might otherwise destroy the mold by causing an explosion when the molten metal is poured in. The core being adjusted and the gates formed, the box is closed and clamped as before.

This method of molding is the simplest and is perfectly suitable for any plain casting, but in a more elaborate piece of work, where the ornament is *undercut*, a different method must be resorted to, or the undercut portions, when withdrawn from the mold, will tear out a part of the sand with them. This method will be explained later.

14. Core Boxes.—The molds in which sand cores are made are called **core boxes,** and may be of wood, plaster, or iron, the space in the box corresponding in shape with the core to be molded. In some cases, the pattern is used also in making the core box. As an illustration, Fig. 14 (*a*) is one-half of a pattern from which hollow castings are to be made. It is shown lying on a board with core prints *e e* at each end. This pattern is embedded in plaster or a regular

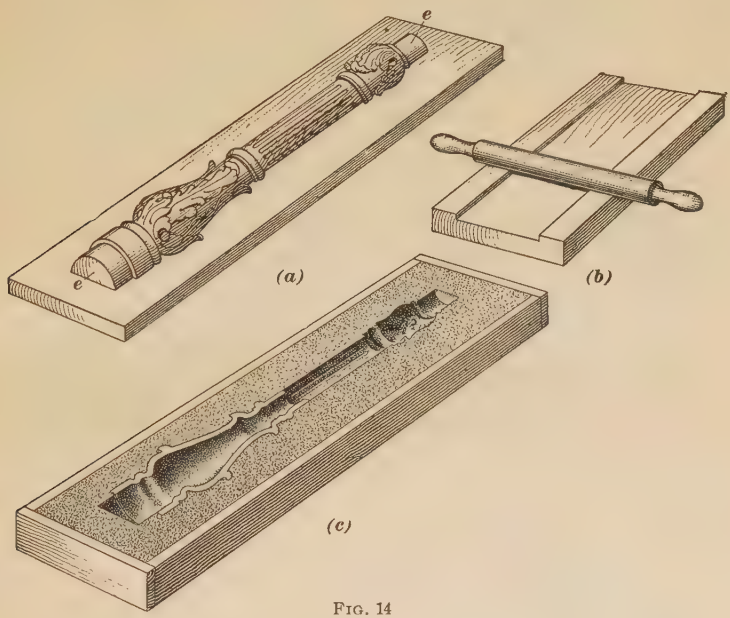


FIG. 14

sand mold is made from it. Then a board and roller, Fig. 14 (*b*), are made, the edges of the board being raised equal to the desired thickness of the casting. Soft clay is laid on this board and rolled into strips, with which the sand or plaster mold is lined. Fig. 14 (*c*) shows the mold partly lined. This clay lining adapts itself exactly to the shape of the mold, and if an impression of the lining is taken, a model of the required core will be obtained. From this model can be made another plaster mold, which becomes one-half of the core box. It will look very much like the original mold

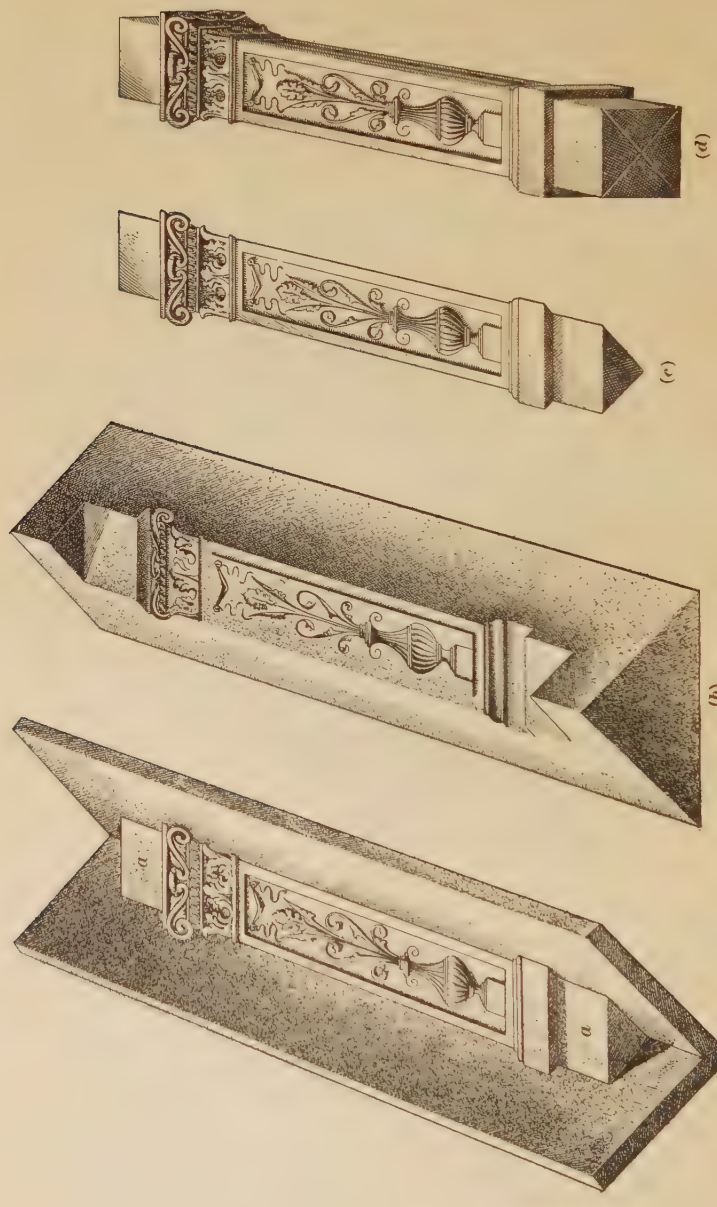


FIG. 15

taken from the pattern, without all the finer details of ornament, but the size of the cavity will be the thickness of the lining smaller, and this, of course, is what is desired.

15. Molding Four-Sided High-Relief Ornate Shapes. If the ornament is very bold, the pattern should be arranged in some other manner, otherwise it will not draw clear of the sand. There are various ways of obviating this difficulty, one being as follows:

Two boards somewhat longer than the required model are fastened together, as shown in Fig. 15 (*a*), forming a right angle, and in this is modeled one-quarter of the pattern with projections *a* at each end to form the core prints. When this

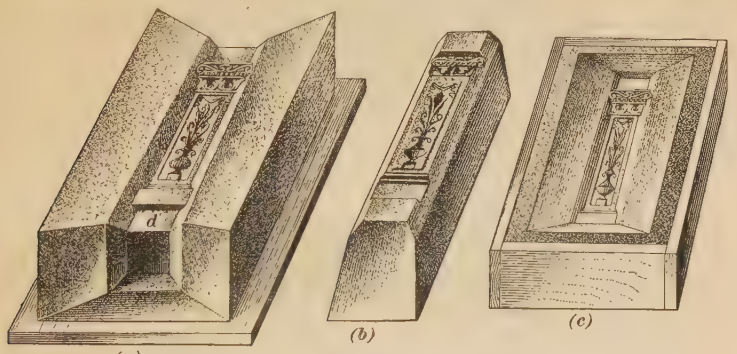


FIG. 16

model is complete, it is varnished and oiled. A plaster cast is then made by pouring plaster of Paris over the model and entirely filling up the angle between the boards, the result being a solid block with a reverse impression, as shown in Fig. 15 (*b*). This block when dry is used as a mold to produce the four quarters, Fig. 15 (*c*), needed to complete the original pattern. To make these four quarters, plaster is simply poured over the block (*b*), and roughly heaped up to form a ridge; then, by drawing a straightedge against each side of it in turn, the resulting casts are properly mitered, and may be fastened together with shellac, forming a complete model, as shown at (*d*).

The model is laid on a board and leveled up, as shown at *d*, Fig. 16 (*a*). The ornament at several points may rest on

the board, but the body will be clear. It is then bedded up with clay, sloping the clay from the line of the lower edge of the model gradually down to the level of the board. Then the model is oiled to keep the wet plaster from sticking, and a plaster cast is made of both sides, sloping the plaster upwards to the top edge, and beveling the sides and ends as shown, the object of which will be seen later.

In Fig. 16 (*a*) the model is shown resting on a board, with the two plaster casts of the sides completed and lying against it. These casts, or molds, when detached, appear as shown in Fig. 16 (*b*). A plaster mold is made from each of these blocks. As these molds will be used in the foundry repeatedly, they should have a rough wooden frame to protect them from fracture, as shown in Fig. 17 (*a*).

Two blocks, as shown in Fig. 16 (*b*), are attached firmly with shellac to each side of the original pattern, thus bringing it back to the form shown in Fig. 16 (*a*). The pattern thus treated is ready to be put in the sand and consists of the main part, Fig. 16 (*a*), and the molds for the side parts, Fig. 17 (*a*). The original pieces, Fig. 15 (*a*) and (*b*), are kept only for the purpose of replacing the working patterns in case of accident.

This pattern *d*, Fig. 16 (*a*), is laid on its board and molded in the usual way. When the box is opened and the face of the pattern is brushed off, it will then appear as shown in Fig. 16 (*c*). The upper part of the box is then put in place and rammed up with sand, after which the box is opened and the pattern removed. The mold is left almost wholly in the lower box, as shown in Fig. 17 (*b*), and partly in the upper box, as shown in Fig. 17 (*c*). The plaster mold, Fig. 17 (*a*), is filled with sand, and so is the corresponding mold for the other side, thus making two blocks that correspond in shape and size with the recesses *m*, *m* left in the mold, Fig. 17 (*b*), into which they are carefully slipped. The core is put in place and the molding box is closed. The mold is now ready for the metal, it being understood that gates and outlets have been provided.

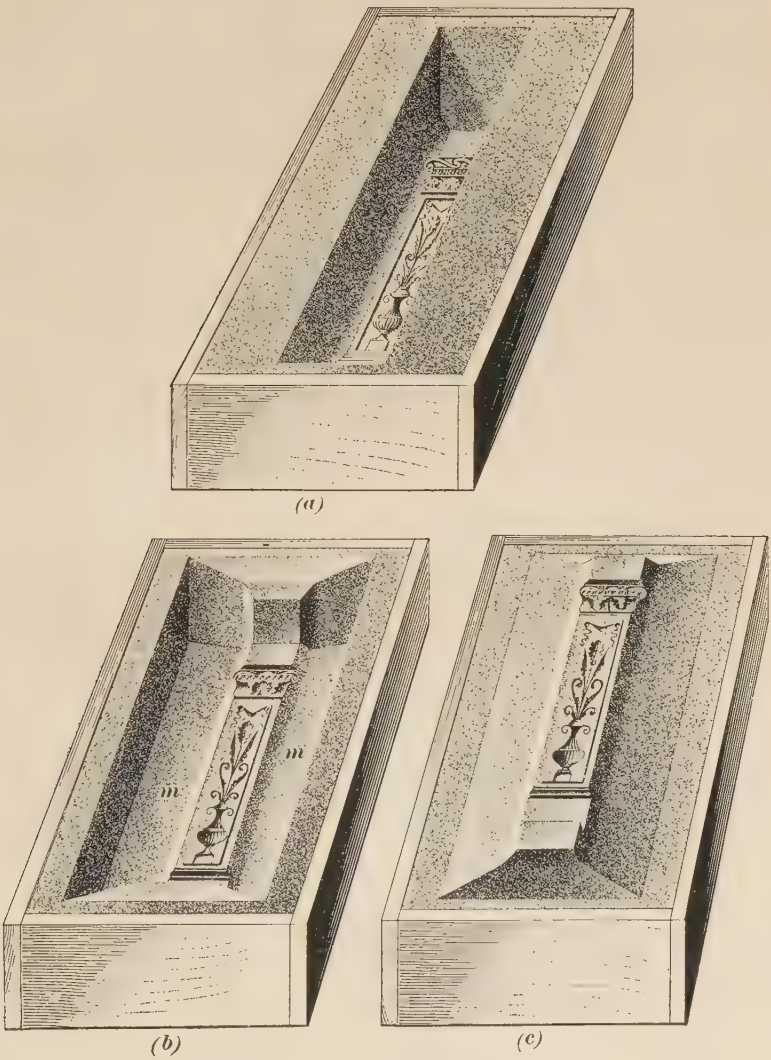


FIG. 17

16. The ornament in the example just given, although in such high relief as to preclude the pattern being made as mentioned in connection with Fig. 13, is not really undercut, as any one side could be drawn free from the sand. It is the combination of the four sides, together with the bold ornament, that necessitates the peculiar arrangement of the pattern. There are other means of reaching the same result, such as making the ornaments on two sides of the pattern detachable, so that after withdrawing the main part, or body, these loose pieces are left in the mold and can be picked out separately.

17. Undercut Work.—In undercut work, this latter method of making the ornament separate, to be picked out after the main part of the pattern has been drawn, is sometimes successful. The following will explain more fully what is meant by **undercut work** and how the patterns are adapted to meet the difficulty. Fig. 18 (*a*) shows a plain, flat square, or rectangular slab, with a vertical rib on

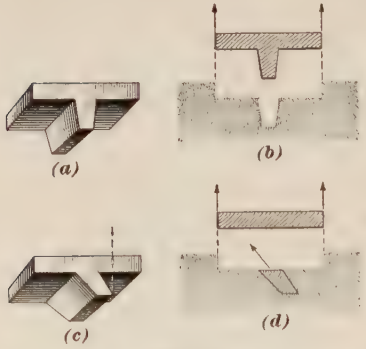


FIG. 18

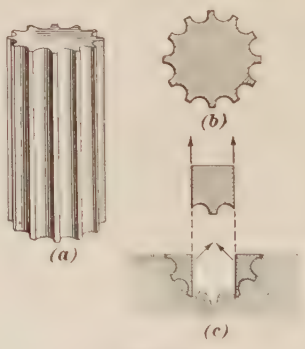


FIG. 19

the under side. It is evident that any such article may be molded in the ordinary way, as the entire pattern can be drawn straight upwards in the direction of the arrows, as at (*b*). Now, suppose that the rib is inclined at an angle, as shown at (*c*); the conditions are changed so that the pattern cannot be drawn in the same manner as in the previous case. The obvious solution of the difficulty is to make the pattern

in two pieces. Then, the upper section can be lifted vertically, leaving the rib to be drawn subsequently, as indicated by the single arrow in (*d*).

A somewhat different case is shown in Fig. 19 (*a*), being part of a fluted shaft, a section of which is also shown at (*b*). It will be seen that if this pattern were made in one solid piece, or even if the pattern were in halves, and had sand packed all around, being cast on its side, it would be impossible to get it free without breaking up the mold. The pattern should be divided into halves, and each half subdivided as shown at (*c*). Then, the middle section can be drawn straight upwards, and each of the side sections may be drawn inwards sufficiently far to clear the sand before being lifted out. In both of these cases, the result is gained by using loose pieces, or, in other words, by subdividing the patterns.

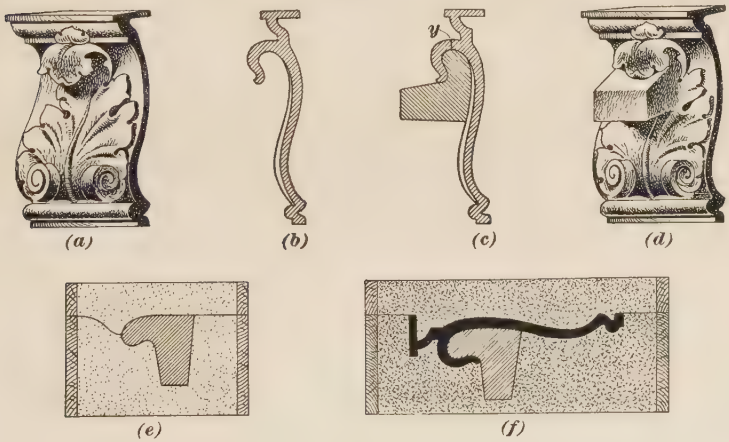


FIG. 20

18. Fig. 20 represents an example where other methods must be employed. The upper part of the foliage overhangs and forms a deep undercut hollow. At (*a*) is shown the original model, which is of clay, and (*b*) shows a section through the middle of the leaf. In order to get a working pattern, the model is laid flat on its back and plaster is poured into the hollow of the leaf so as to form into a

square piece that will project outwards, as shown in section at (*c*) and in perspective at (*d*). This piece is called a *point*. At this stage, the whole model is turned over and plaster is poured over the back of it, forming a solid bed, or match. It is now required to separate the plaster point from the model. To do this, the top of the leaf at *y*, Fig. 20 (*c*), must be cut or broken away. Next, a plaster mold is made of this point, as at (*e*), and when this is done the point is replaced on the model and the top of the leaf is fixed in place again.

The model thus prepared and lying on its bed is covered with the molding box and the sand is "rammed home." The whole is then turned over, the block removed, and a sand mold made of the reverse side of the model. This half of the mold is lifted off, and the model is drawn (which can be done freely, since the hollow of the leaf is filled up by the plaster point). Meanwhile, a sand impression of the point has been made from its plaster mold, and this impression, or *core*, as it would be called, is dropped into its place in the space left for it by the plaster point in the sand mold, as at (*f*). The proper gates and vents being provided, the casting can now be poured. If the ornament should chance to be undercut at the lower part of the leaf also, additional points would be made in the same way.

19. In the process of casting, it is not good practice to have heavy pieces cast adjacent to much lighter ones. As the lighter parts cool very quickly compared with the heavy portions, the result would be disastrous, owing to the unequal shrinkage of the metal. Thin pieces shrink in a very short time, and in doing so are liable to crack away from the thicker parts, which retain the heat longer and consequently do not shrink so rapidly. These remarks should not be taken to mean that every casting must be of exact thickness throughout, but where there are variations of this kind adjoining, thick and thin sections should be graded together gradually, avoiding as much as possible any very abrupt change from one to the other.

A casting designed without regard to this matter may be molded successfully and in some cases the unequal shrinkage of the parts may be avoided by opening the box as soon as the molten iron has had time to solidify and thus exposing the thick portions to the atmosphere, while the thinner parts remain covered with the sand, in order that they may retain the heat for a longer period and thereby somewhat equalize matters. Even then there would be a certain amount of latent strain left, which would likely be sufficient to cause a subsequent fracture should the casting be subjected to a sudden jar or impact.

Having thus far described the use of iron as a medium for decoration and the processes generally used for cast-iron patternmaking, molding, and casting, the different structures and parts generally made of iron will now be considered.

STRUCTURAL DETAILS

20. Screws and Bolts.—In Fig. 21 (*a*) is shown what is termed a *square-head bolt*. Bolts of this kind are used for all common connections, such as the joining of two flanges or other surfaces that are not exposed to view. At (*b*) is shown a *screw-head bolt*, which is used for work where a countersunk head is necessary in order to obtain a smooth surface, the slot in the head being filled with putty after the work is in place. At (*c*) is shown a *countersunk-head bolt*, used for the same purpose as a screw head, and also for securing wooden stair treads to wrought-iron strings, so as to permit the head to finish flush with the tread. The countersunk-head bolt is also used in joining flat surfaces where a smooth finish is required.

At (*d*) is shown a *tap bolt*. This bolt is used for all connections where it would be impossible to get a nut on the end. The hole into which this bolt is to be screwed has a thread cut in it, or is "tapped," as the technical phrase would express it. At (*e*) is shown a *countersunk tap bolt*, which is used for joining very heavy work that requires a smooth-finished surface. After the bolt has been

tightened up by the aid of a wrench, the square head is cut off.

Lagscrews, shown at (*f*), are used to fasten iron to stonework or woodwork; a plug of soft metal or wood is driven into a hole drilled in the stonework, and the screw is inserted into this plug.

At (*g*) is shown a *double-expansion bolt*, used for fastening work to brick or stone walls, and consists of a threaded bolt

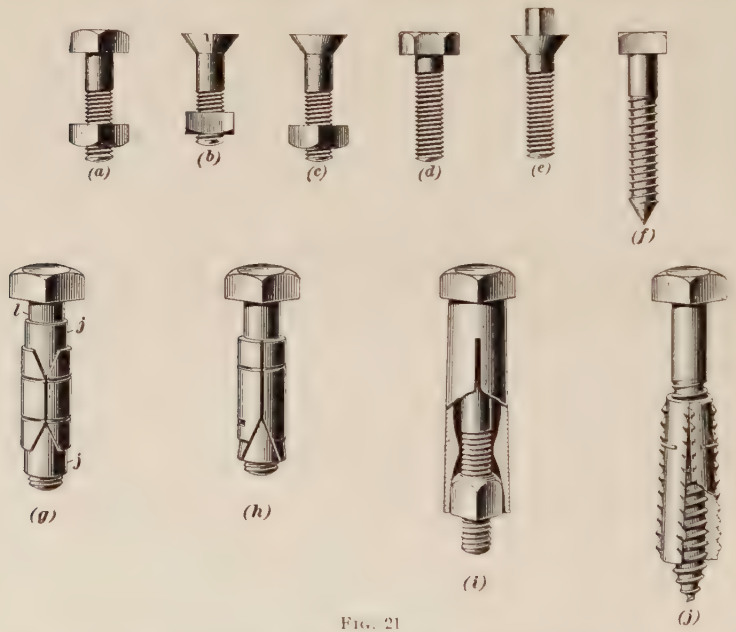


Fig. 21

and an expansion shell into which the bolt screws. In using these bolts, the shell is first inserted into the hole made for it and the bolt is screwed into this. As the bolt *l* advances against the object to be fastened, the parts at *j*, *j* are pushed together, gradually spreading the shell and causing it to firmly grip the sides of the hole. The *single-expansion bolt* (*h*) acts in the same way, and is used for the same purpose. The chief advantage of these bolts is that they may be taken out without damaging the surrounding stonework or

brickwork. At (*i*) and (*j*) are shown two other types of expansion bolts; the shell on (*j*) is often made of lead, which accommodates itself very closely to the surface of the hole as the bolt is screwed up. Expansion bolts are also made with screw heads, for use where the surface will be exposed to view.

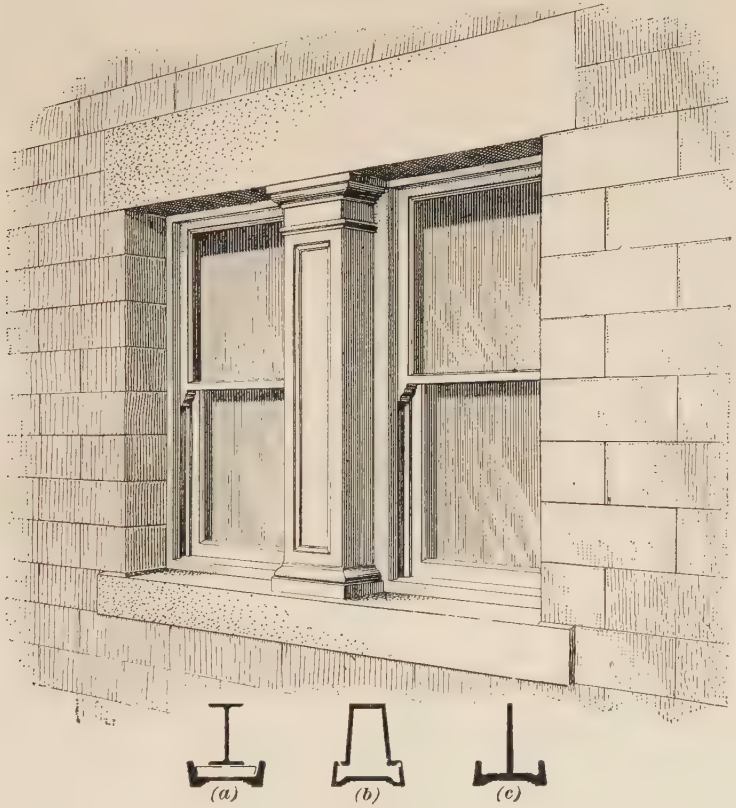


FIG. 22

21. Mullions.—A window such as shown in Fig. 22 is sometimes so wide that it requires a mullion, and the design of this mullion must be consistent with the rest of the building, no matter what its construction may be. In Fig. 22 is illustrated three ways of constructing such a mullion: (1) with an upright I beam and cast-iron facing, as shown

in plan at (*a*); (2) with a cast-iron box on which the ornament is cast, as at (*b*); and (3) a modification of these two, which consists of a **T**-shaped casting with the ornament on the face, as at (*c*). The advantage of the first method is that the ornament may be applied without regard to the structural support, while in the other two, sufficient allowance must be made in the thickness of the metal to proportion the support to the load.

Fig. 23

In the first example (*a*), the cast-iron facing is screwed or bolted to the **I** beam. The decoration may be a simple panel, as shown, or a highly ornamented arabesque, according to the requirements of the design, for so long as the sides are plain, the casting of the mullion presents no particular difficulty, being only a plain panel, the pattern for which would be of wood about $\frac{1}{2}$ inch thick with the sides slightly beveled or drafted to allow it to be drawn freely from the mold.

The length of the mullion is 8 feet; therefore, the pattern should be 8 feet and 1 inch in length, to allow for shrinkage.

If the design of the mullion is ornamental, the pattern may be entirely of plaster, or the body of wood and the ornament modeled in clay. If there are to be a number of these mullions in the façade, only one model is made; and, by covering this with plaster of Paris, a mold is obtained from which any number of wax duplicates can be cast of the original, which are then mounted on the body of the pattern for the mullion.

In the second case (*b*), the pattern should be made in a similar manner to (*a*), but, in addition, a core box is necessary, in which the sand core is made to be placed in the mold so that the desired thickness of metal is obtained. The sides of this mullion are checked or rabbeted to receive

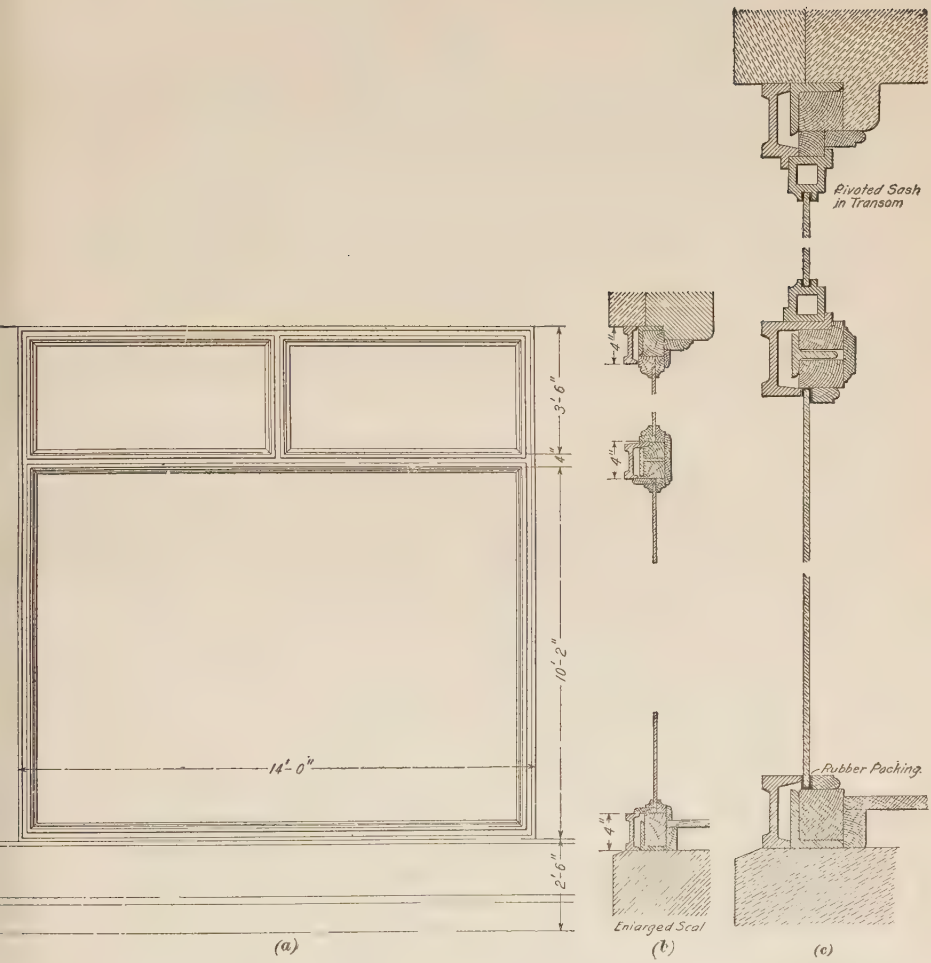

3'-6"
4"
10'-2"
14'-0"
2'-6"
4"
4"
4"
Enlarged Seal
Pivoted Sash in Transom
Rubber Packing
(a)
(b)
(c)

FIG. 24

the window frames, while in (*a*) and (*c*) the frame passes back of the reveal or side of the mullion.

The third case (*c*) should only be used where the superimposed load is small; its chief advantage lies in the fact that it does away with the use of the I beam without requiring a core for the casting, thereby saving both in the cost of manufacture and in the setting.

Mullions are sometimes set in between the sill and the lintel and fixed thereto, but in fireproof buildings with beam construction, a better plan is to run the back member, or web, of the mullion from beam to beam, so as to bind it securely to the framework of the building. Fig. 23 is a side view of a mullion fixed in this manner.

22. Window Frames.—Cast-iron window frames are sometimes designed as mere outer protection for the real wooden frames, as shown in Fig. 24 (*a*) and (*b*), where the ironwork is made after this fashion. This arrangement occurs mostly in show windows, and may be decorated as desired. The sash above the transom bar may be pivoted at the sides, so as to swing open for ventilation. Fig. 24 (*c*) is a vertical section of a similar window with no woodwork exposed to the action of the weather, the transom sash in this case being of metal. There is a structural frame of angles and tees with their ends built into the brickwork or fastened with expansion bolts, whichever is most expedient. To this frame the outer ironwork is screwed or bolted.

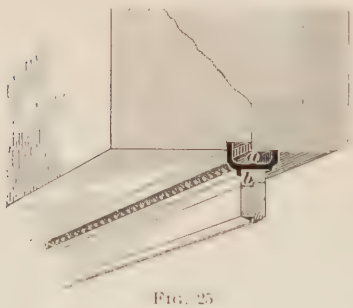
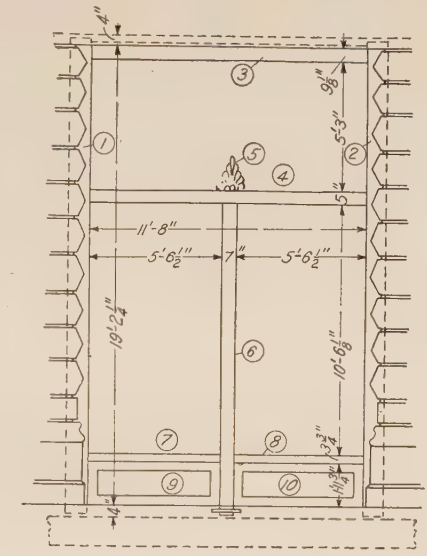


FIG. 25

This class of window is also framed as shown in Fig. 25, where the section of the window soffit shows a cast-iron frame, the outer edge of which takes the place of the weather stop and is ornamented with an egg-and-dart molding. The section of the iron jamb and head shown at *a* may be used

for either a stationary window set directly in the iron frame or a French sash window, the hinges of which are secured to the iron frame with countersunk tap screws; or, when a wooden hanging stile is introduced, as shown at *b*, a pivoted sash may be used. The decoration of the weather stop and the inside of the frame should conform to the general design of the building.

The pattern for the body of the frame would be modeled in wood, and the decorated parts would be done in clay, cast in plaster, and applied to the body of the pattern. The outer and inner faces of the frame should have considerable draft, so that the casting may be easily withdrawn from the mold.



23. Although vertical sections are given in the preceding illustrations, they are by no means working drawings, and in order to show how this kind of work is prepared for the shop, examples are given in Figs. 26 and 27.

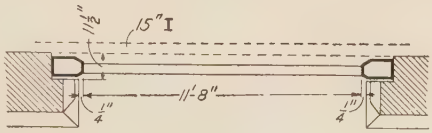


FIG. 26

Fig. 26 shows a block elevation and plan, or horizontal section, of an iron window frame, the sash of which is to be of wood. The various pieces are few in number and simple in design. Before commencing to lay out the working drawings of the ironwork, it is assumed that the stonework surrounding the opening is either already built or has been

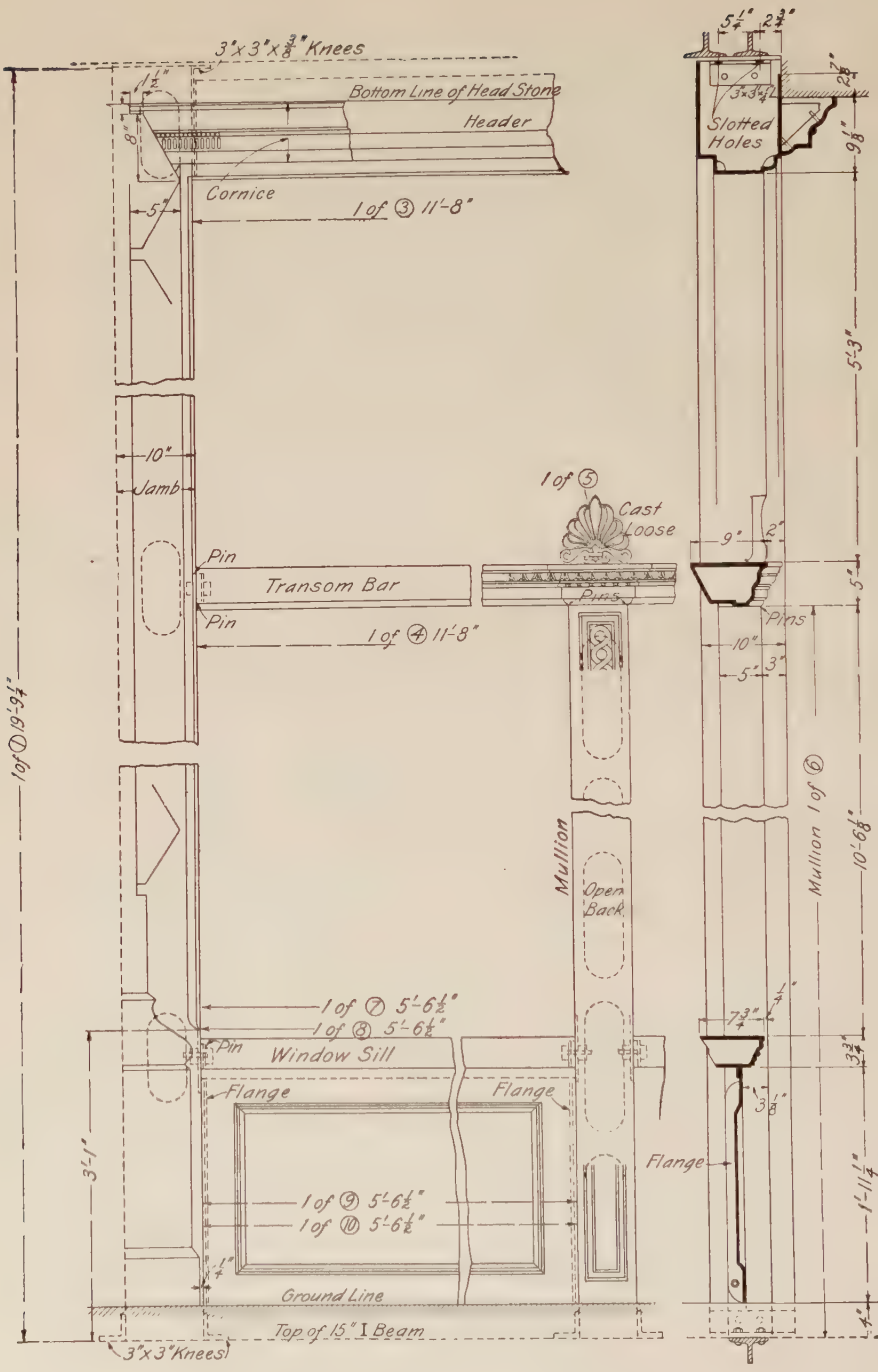

3"x3"x⅜" Knees
Bottom Line of Head Stone
Header
Cornice
1 of ③ 11'-8"
10" Jamb
Pin
Transom Bar
Pin
1 of ④ 11'-8"
1 of ⑤
Cast Loose Pins
Mullion
Open Back
1 of ⑦ 5'-6½"
1 of ⑧ 5'-6½"
Pin
Window Sill
Flange
Flange
1 of ⑨ 5'-6½"
1 of ⑩ 5'-6½"
Ground Line
Top of 15" I Beam
3"x3" Knees
1 of ① 10'-9¼"
3'-1"
Slotted Holes
3x3½
9"
5'-3"
9"
2"
Pins
10"
5'-3"
Mullion 1 of ⑥
10'-6⅝"
7¾"
3⅜"
Flange
1'-11½"

FIG. 27

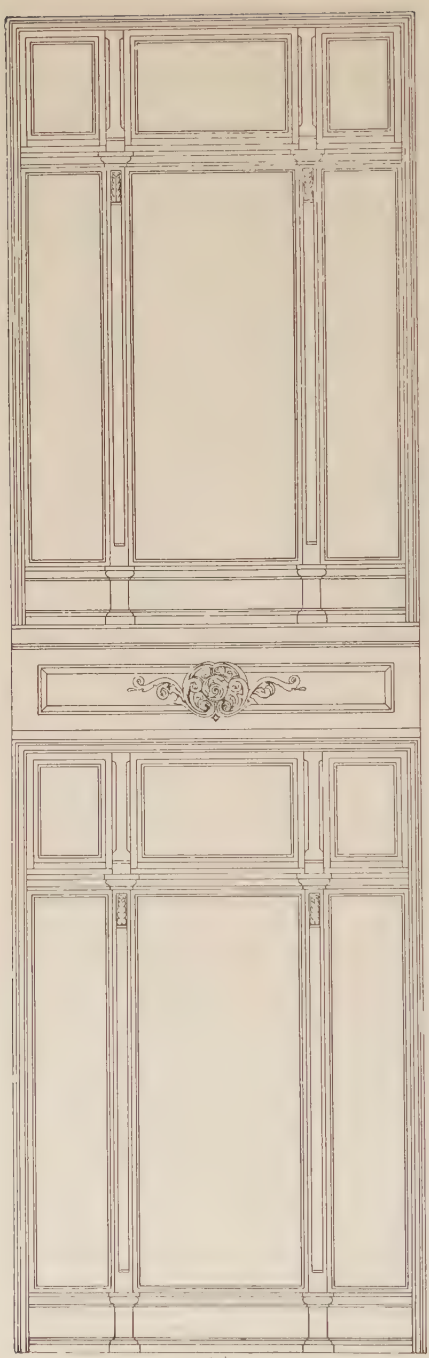
definitely decided on, so that the measurements may be obtained. These measurements being secured, the iron-work should be drawn full size for the information of the patternmaker. From the full-size drawings, it is an easy matter to draw the scale details necessary for the fitter and erector.

Usually, the molder does not need working drawings, as he gets his order for so many pieces to be cast from the pattern as they are handed to him. The fitter, on the other hand, should have scale details showing how the work is to be assembled, and the same applies to the erector, the full-size drawing being too unwieldy for general use. On the block elevation and plan, Fig. 26, are marked the general sizes and piece numbers of the parts, and on the larger detail, Fig. 27, is given fuller information, together with the quantity required of each casting with its corresponding piece number. The latter drawing also shows the construction of the whole, and should be supplemented by a written schedule, or list, of every piece entering into the composition of the completed work.

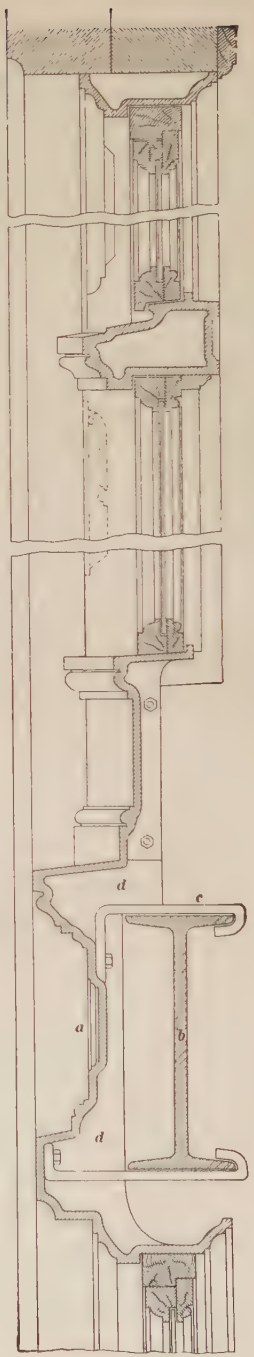
24. There is practically no limit to the use of iron as building material, and in many of the modern office buildings and hotels one of the principal features of the architecture is the long window bay running through half a dozen or more stories as shown in Fig. 28 (*a*). These may be constructed either entirely of iron or with iron frames and fascias, the sash being of wood or some light metal.

The section, Fig. 28 (*b*), shows the frame, transom bar, and fascia. Behind the fascia *a* is the floor construction with probably a beam, or girder *b*, to which the fascia is attached with hooks and bolts *c*, of whatever shape may be most expedient. Ribs *d*, *d* are cast at intervals on the back of the fascia, so as to bear against the top and edges of the beam. The hooks, or clamps, are made of the size and shape to suit the position they are to occupy.

The upper part of such a series of window bays surmounted by an imposing balcony is shown in Fig. 29. This

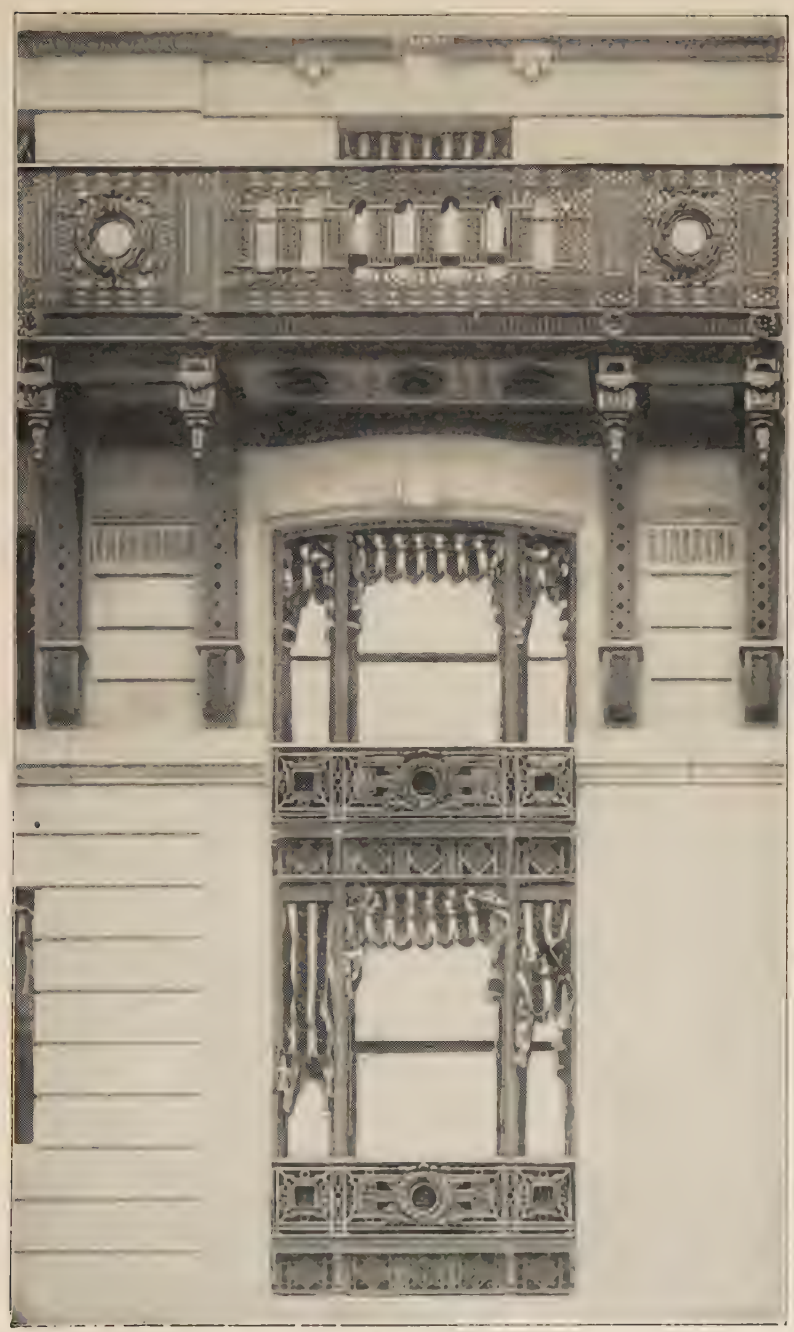


(a)



(b)

FIG. 21



particular design is an excellent example of the successful application of ironwork to building construction.

25. It frequently happens that the window-frame casting includes the outside casing and molded reveal, as in Fig. 30, which shows a richly ornate soffit. In this case, the reveal of the soffit *a*, or the jamb at the side of the opening, is first set, then the frame *b* is put in place, and last the casing, or architrave, *c*, the head of which is checked into the stonework. In the modeling and casting of these pieces the architrave *c* has the rosette ornament and reveal *b* has a repeating ornament both of which are molded and cast separately. By this

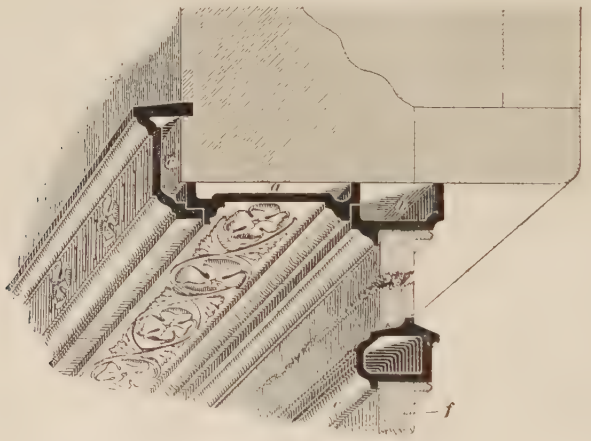


FIG. 30

procedure, only one model is required for the rosette and one for the repeating ornament, and castings from these are taken until the required quantity is obtained. Thus, in case of a failure in casting the ornament, the entire casting of the soffit or architrave is not made worthless, as it would be if the ornament were cast with the main detail in one piece and a portion of the ornament proved defective.

26. Door Frames.—As a rule, when cast iron is used for a door frame, it is more properly a jamb and architrave, though in some cases the door frame itself is of iron, the same as a window frame, and the hinge butts are

secured directly to it, unless a wooden frame has also been provided. The design shown in Fig. 31 is the soffit of a simple molded jamb and architrave, the wooden-door frame being fitted against it. Both the jamb and the architrave are secured to the stonework with expansion bolts, and the joints are bolted together with countersunk screw bolts. In designing a door frame, two chief points to bear in mind are the draft and the proper location of the joint between the two pieces. All joints of this character should be specially designed and so placed that they may form a practically invisible meeting line between two moldings, as shown at *a*. In very large work, and in buildings that are entirely of iron construction, it is better to set up, 2 feet apart, a series of $2'' \times 2''$ angle-iron jamb pieces to which the door jambs may be bolted; the inside ends of the latter have knees to which the door frame proper is bolted. The architrave should also have an angle-iron frame set up against the stonework and secured with expansion bolts, and the architrave should be fastened to this with countersunk screw bolts.

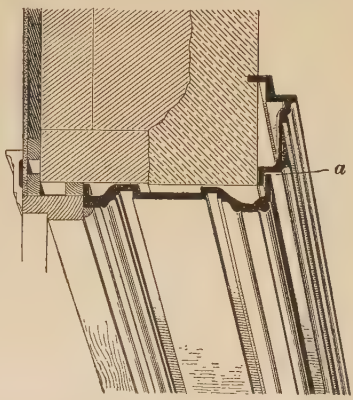


FIG. 31

27. Drawings for Window Frames.—The series of drawings shown in Fig. 32 illustrates a combined entrance and show window. With the exception of the full-size details, which cannot be reproduced here, this series forms a complete set of working, or shop, drawings. The general design of the ironwork is in harmony with the building of which it forms a part, and the details are worked out piece by piece in proper relation to each other and to the whole.

After the design is made, and before the work is detailed, it is necessary: (1) To measure the brick piers and the width of the whole opening between them; (2) to get the

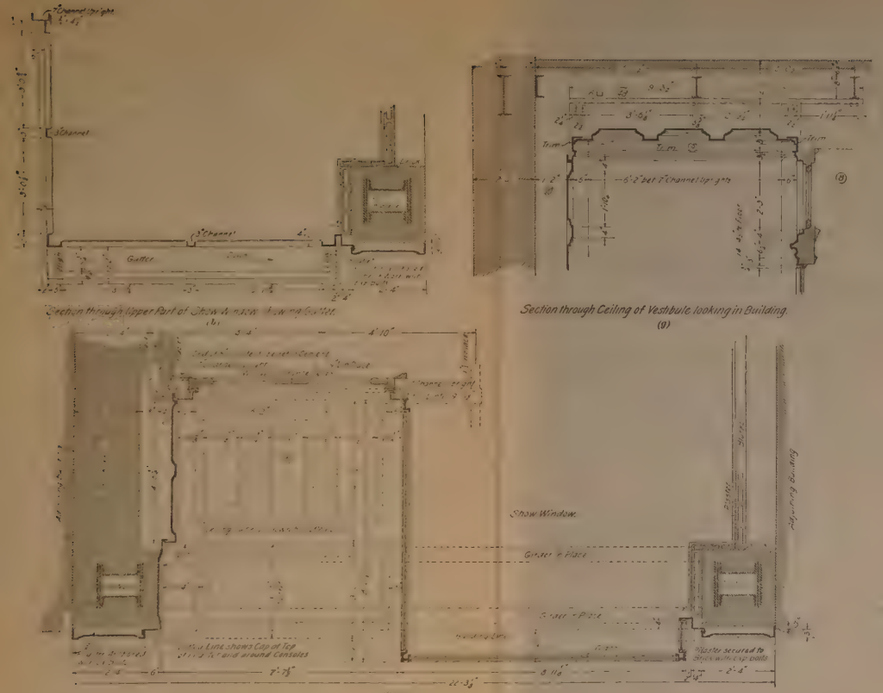
height from the first floor level to the under side of the girders overhead; (3) to note the exact position of the beams and girders at the ground level, together with their sizes; (4) to find the various levels of the sidewalk and the inside floor, and in fact to collect all information pertaining to the stonework, brickwork, and structural ironwork to which the ornamental work of the entrance and show windows is to be connected.

Having obtained all the data, and having the design already prepared, the working out of the details should proceed naturally. First comes the plan, Fig. 32 (*a*), which, like most plans in architectural drawings, is really a horizontal section; next, the plan, Fig. 32 (*b*), through the upper part of the show window; and then the front elevation, Fig. 32 (*c*), and the various sections (*d*), (*e*), (*f*), and (*g*).

The space left between the brick wall and the iron panel on the one side and between the adjoining building and the furring blocks on the other side is for pipes, otherwise the iron panel might have been set back close to the brickwork.

These drawings should be made in the order given, but as each one is so intimately allied to the other, it will be found that the details of construction will work themselves out as a whole. For instance, the facing of the piers and the plates and panels of the vestibule will be determined in relation to the height and width of their parts, as shown by the elevation and sections, so that as the drawings progress there will be a constant reference from one to the other. It should be borne in mind, however, that most of this work is drawn full size, and that scale details are merely smaller reproductions of the large drawings made in a convenient size for the use of the artisans in assembling, fitting, and erecting the work.

The reasons for putting up any structure are as varied as are the designs of the work. When it is remembered that there is practically no load to be supported and that the position of the joints are determined to a great extent by considerations of convenience, there can be no fixed rule in regard to this matter. To be successful, a knowledge of



Section through Upper Part of Show Window showing Gutter.
(b)

Section through Ceiling of Vestibule looking in Building.
(g)

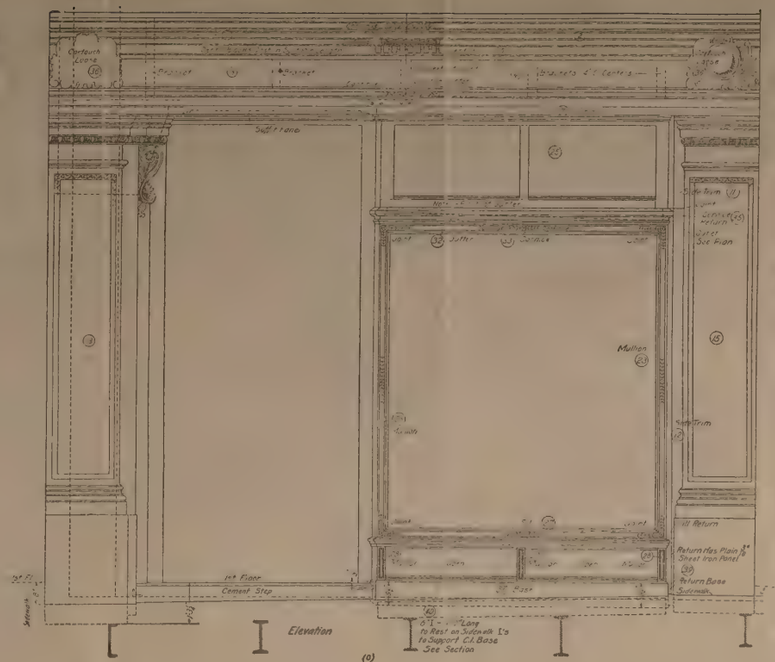
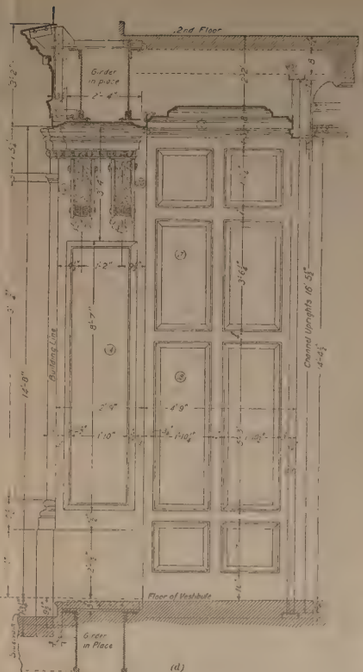
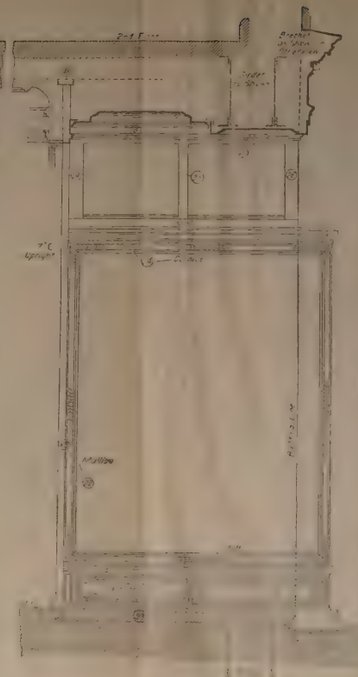


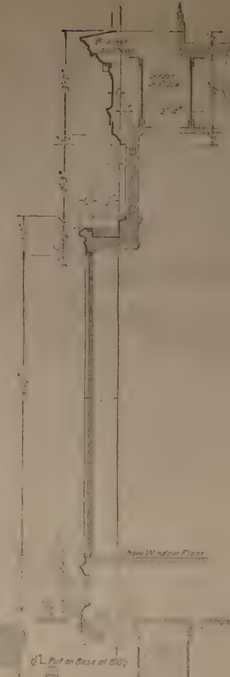
Fig. 32



Section Through Vestibule Showing Left Side.



Section Through Vestibule Showing Right Side.



Section Through Store Front.

molding is indispensable, in order to avoid bent and twisted castings. A careful examination of these drawings is better than any written explanation.

28. An excellent exercise is to make a complete schedule of this entrance and window, drawing each piece separately, both front view and section, and identifying it by its number (shown in the details enclosed in a circle). The result will be a very thorough understanding of the whole subject.

The pieces are numbered as follows: Cornice, *1*, *2*; frieze, *3*, *4*; dentils, on cornice, *5*; trim over window, *7*; trim around vestibule, *8*, *9*, *10*; trim at side of window, next pier, *11*, *12*; pilasters, *13*, *14*, *15*; ceiling, *16*; vestibule panels, *17*, *18*; consoles, *19*, *20*; soffit, *21*; mullions, *22*, *23*, *24*, *25*, *26*, *28*, *29*; sill, *27*; base panel, *30*; gutter, *32*; cornice, *33*, *34*, *35*; cartouch, *36*; base, *37*, *38*, *39*; various channels, angles, etc., *40*, *41*, *42*, *43*, *44*, *45*, *46*, *47*, *48*.

There are a few additional small pieces, such as angle knees and plates, which are attached to the larger parts, and belong to them. These are not distinguished by separate numbers.

STAIRS

STRAIGHT-RUN STAIRS

29. Stairways.—The stairways in public buildings should be of iron, and by reason of the prominence of their location, it is usually necessary that their design should be in accordance with their surroundings. A number of stairways are herein shown, not to give a variety of examples, but to illustrate the different conditions that are likely to arise. Any of these designs may be stripped of its ornament and be used in the plainest structures, or the ornament may be increased and the design made suitable for a most elaborate interior.

The stairs shown in Fig. 33 are suitable for such use as a basement stairway or in a place where two floors are leased or used by one occupant and communication between them is necessarily independent of the public halls and stairs.

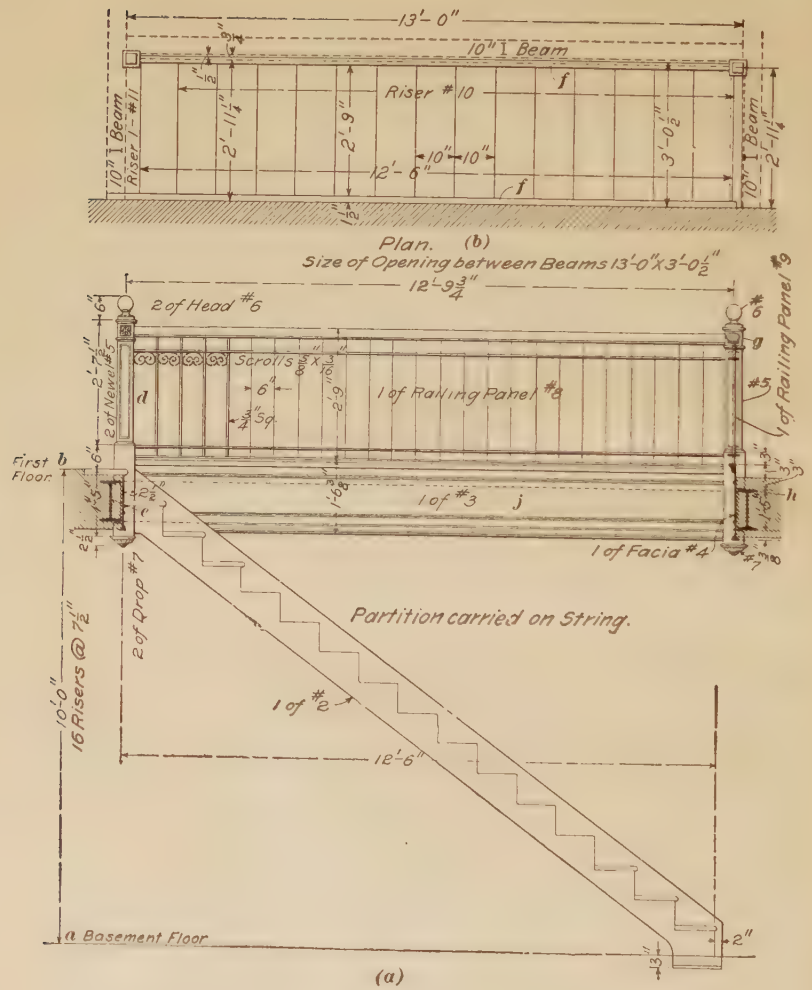

13'-0"
10" I Beam
Riser #10
2'-9"
12'-6"
10" I Beam
Riser 1-#11
2'-11¼"
3'-0½"
Plan. (b)
Size of Opening between Beams 13'-0" X 3'-0½"
12'-9¾"
2 of Head #6
2 of Newel #5
Scrolls
1 of Railing Panel #8
1 of Railing Panel #9
1 of #3
1 of Facia #4
First Floor
Partition carried on String.
2 of Drop #7
1 of #2
16 Risers @ 7½"
10'-0"
12'-6"
a Basement Floor
2"
(a)

Fig. 33

30. In laying out the drawings for the flight of stairs shown in Fig. 33, locate the center line of the newel *d*, 1 inch from the face of the beam *e*, and the face of the last riser at the center of the newel, and from this riser measure off $15 \times 10 = 150$ inches (there being fifteen treads), which will be 12 feet 6 inches and there locate the position of the face of the first riser. The framed opening of the well through which the stair is raised is more than the length of the stair, so that the headroom does not necessarily have to be considered. The width of the opening is 3 feet. The rise, the tread, and the position of the newel, the first and the last riser, and the width of the opening being fixed, a plan, as at (*b*), should be laid out, then the section (*a*), which shows the inside face of the string that finishes against the newel. The next point to consider is the finish of the well; this, as shown in the section (*a*), has a molded fascia *j*, a light hand rail of wood, a balustrade of wrought iron composed of $\frac{3}{4}$-inch square balusters with a top and a bottom rail, and two additional rails forming a frieze and dado through which the balusters pass, making a very stiff balustrade. The center line of newel *g* and the end rail are set $1\frac{1}{4}$ inches from the flange of the beam *h*. These points being fixed, the general layout is complete and the next procedure is to make the several parts in detail. It will be observed that the section (*a*) is drawn looking toward the railing.

31. The first piece to detail is the string *f*, the sectional shape of which is shown at *i*, Fig. 34 (*c*). The lug *k* is cast on the string, and supports the ends of the treads. The head of the outside string is cast with the base, or lower part, of the newel on it, and is shown in plan at *d*, Fig. 34 (*b*), and in elevation at (*a*). The plan (*b*) shows a lug *l* cast on the back of the newel that holds the string in place, and is secured to the flange of the beam with a hexagonal-headed bolt; the lug *m* is cast on the inside of the newel to receive the last riser.

On the right side going down, the string is bolted to the solid brick wall with expansion bolts, but on the bottom of

the left-hand string there is a solid plate with braces, as at *u*, Fig. 34 (*c*). This plate carries the fire-block partition on that side of the stair. Instead of a partition there might be

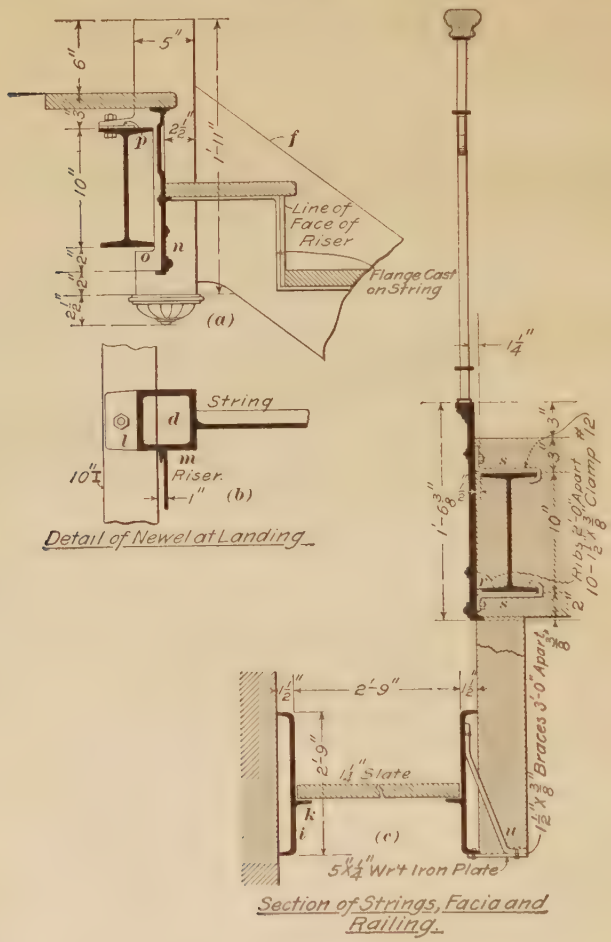


FIG. 34

a piece of open grille-work between the top of string and the floor above, and in that case the string would have no bottom plate but would be molded or ornamented on the outer face. The object of having a solid partition is that

the lower story may be shut off from the upper story, a door also being placed at the foot of the stairs for this purpose.

At *o* and *p*, Fig. 34 (*a*), a small allowance is made for any variation that might arise, thus enabling the erectors to raise or lower the stairs a fraction of an inch in case of necessity.

The angle newel is secured to the beam in the same manner as the newel *d*, and is cast with two lugs, so as to receive both the end and the side fascias. These fascias are cast with ribs *r*, Fig. 34 (*c*), along the back, 2 feet apart, in order to support them. The fascias are held in place by means of wrought-iron anchors *s*, *s*, to which they are bolted with hexagonal-headed bolts, which enable the erector to use a wrench in this close place.

The newels are cast with the upper part of each separate. A wrought-iron rod runs through the base and the shaft of the newel, the lower end passing through a plate in the base, and the upper end through a plate in the head of the shaft; the newel is thus held firmly together when the nut is screwed on. The caps of the newels are cast with a shoulder and are secured to the newel with countersunk screws. The lower rail of the balustrade is secured to the fascia with countersunk screws, and the upper rail in the same manner to the newel and wooden hand rail.

32. In Fig. 35 is shown one of the risers, which, except the top one, are all alike. The flange *v* in the section is cast on the lower edge and receives the marble or slate tread, and the nosing *w* is extended at the back to give a bearing for the tread. At *x* is a check in which the lug of the string fits. The upper riser of the flight differs from all the others, as it must be wide enough to form a fascia and finish under the stairs, as shown at *n* in Fig. 34 (*a*), and at the same time provide a stop for the plaster of the ceiling. The method of casting is not described, as it is perfectly plain work.

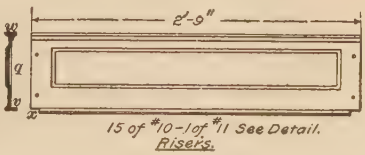
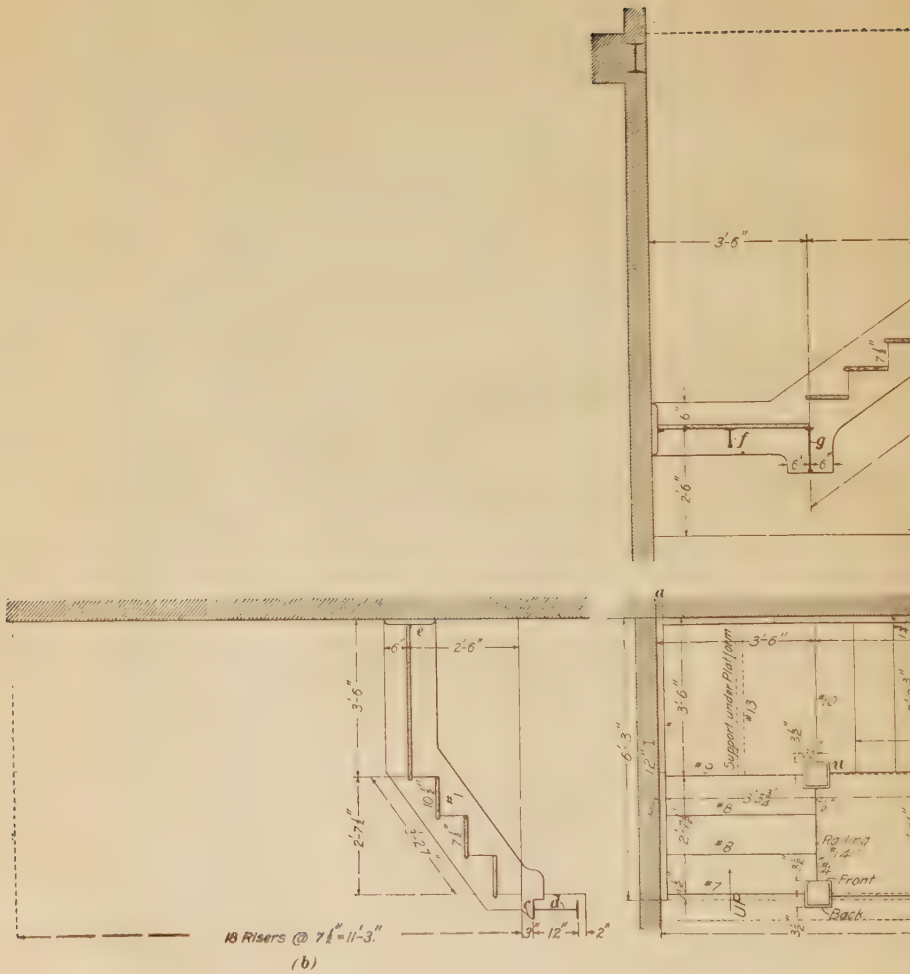


FIG. 35

PLATFORM STAIRS

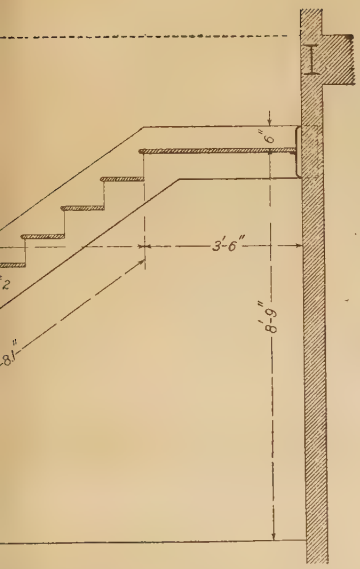
33. The stairs shown in Fig. 36 is one of a series of flights that may be used from the basement to the top floor of a building wherein the stairs just described would be suitable in the basement. This flight represents the run between the third and fourth floors of a building, and is typical of the whole stair system, which is enclosed on one side by a brick wall and on two sides with fire-block partitions. In many respects, the general construction is the same as in the previous example. The course to be pursued in laying out the stairs is the same as described for the previous case. The principal data to fix are: (1) the size of the well; (2) the height of the story; (3) the number of risers and treads, with their height and width; and (4) the width of the stairs. The drawing is then laid out precisely as in the preceding case, except that the parts in this example are numbered in the order they will be required, as is usually done with working drawings, in order to facilitate the process of erection. These numbers are marked on the plans, when laying out the stairs; and the workman, by referring to the plan, finds, for instance, that *# 1* indicates the wall string, which must be first put in place. He consequently first looks for *# 1*, and refers to each piece by its number instead of its name.

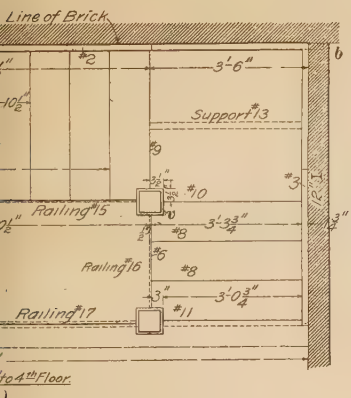
34. The holes indicated by the letters *a* and *b* in the plan, Fig. 36 (*a*), for the reception of the ends of wall strings, are 4 inches deep and contain either an iron or a stone templet for the strings to bear on. The wall string marked *# 1* in the elevation (*b*) has a lug cast on the lower end *c*, through which it is bolted to the top of the beam *d*. At its upper end a lug *e*, which is shown in detail in Fig. 37 (*d*), is cast to receive the end of the string *# 2*, which supports the platform and the stairs on the wall side of the second run. String *# 2*, shown in Fig. 36 (*c*), has two lugs at *f* and *g* cast on the lower end—at *f* to receive the light beam that carries the platform, and at *g* to receive the end of the

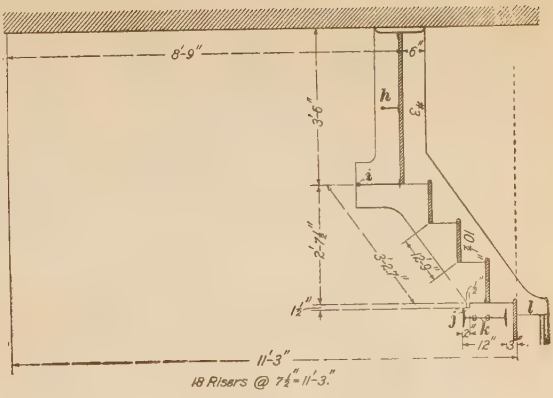


(b)

177-I L T 33C. 273, 308, 332 § 47


6"
3'-6"
8'-9"


Line of Brick
#2
3'-6"
b
Support #13
#9
#10
Railing #15
3'-3 3/4"
#8
Railing #16
#6
#8
3'-0 3/4"
Railing #17
#11
12"
3"
to 4th Floor.


8'-9"
6"
3'-6"
h
3"
i
2'-7 1/2"
3'-2 1/2"
12.9"
10"
1 1/2"
j
k
l
12"
3"
11'-3"
18 Risers @ 7 1/2" = 11'-3."

(d)

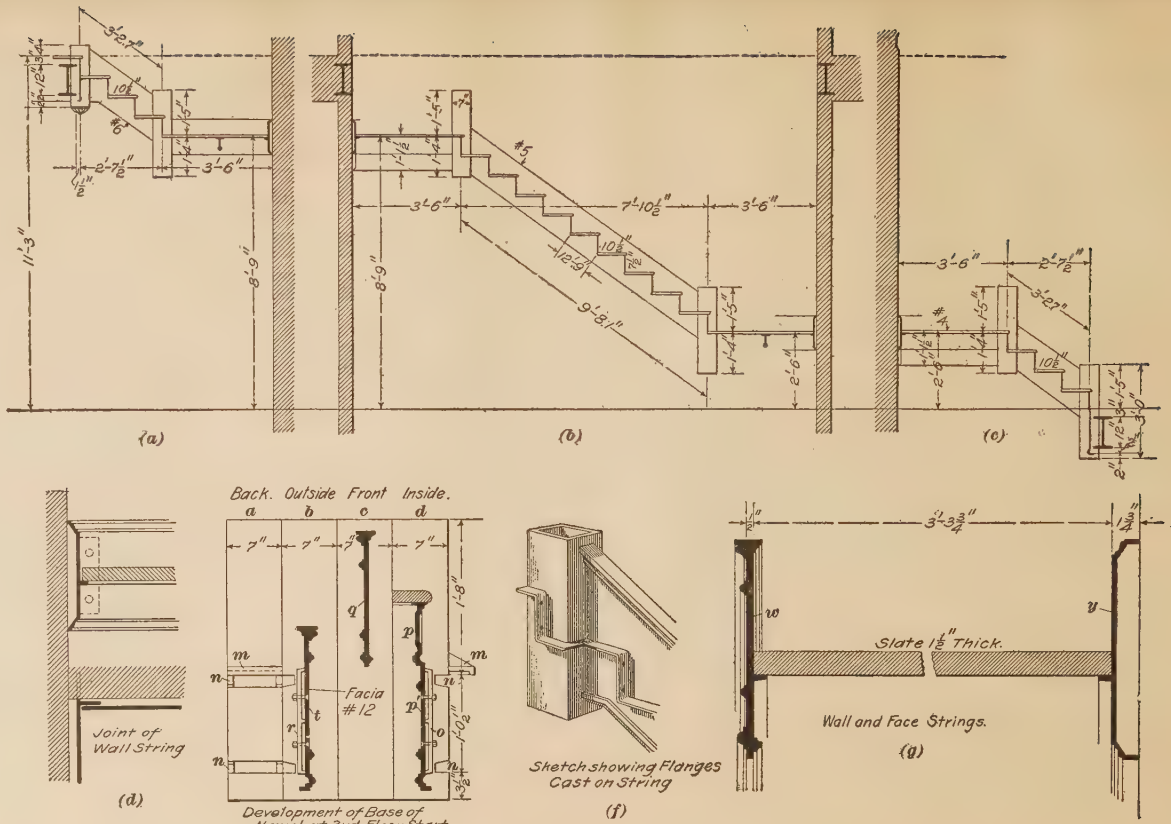

(a)
(b)
(c)
Joint of Wall String
(d)
Back. Outside Front. Inside.
a b c d
Facia #12
Development of Base of Newel at 3rd Floor Start.
(e)
Sketch showing Flanges Cast on String
(f)
Slate 1⅛" Thick.
Wall and Face Strings.
(g)

FIG. 37

face string marked *# 4* on the plan. The upper end of string *# 2* has a lug, the same as that on *# 1* at *e*, cast on it to receive the wall string *# 3*. String *# 3*, as shown in Fig. 36 (*d*), also has on the lower part two lugs at *h* and *i*— at *h* to take a light beam to support the platform, and at *i* to receive the face string *# 5*. On the upper part of *# 3* is cast a flange at *j*, through which it is bolted to the beam *k*; there is also a small extension, or easement, *l* cast on this string to receive the base finish in the hallways. Provision for allowance or variation has been made at the floor ends of the strings *# 1* and *# 3*, as indicated.

35. The face string *# 4*, as shown in Fig. 37 (*c*), is cast with the first two newel bases attached to it, the lower one of which has a lug cast on the back, as shown at *m*, Fig. 37 (*e*), which is a detail of the development of the base, through which it is bolted to the beam. This detail shows the base of the start newel developed flat so as to disclose all four sides. The back *a* is checked out at *n*, so that it may fit over the flange of the beam. The inside face of the newel *d*, against which the first riser must fit, has a lug *o*. The riser *p*, which also extends to form the fascia *p'*, is bolted with countersunk screw bolts to the lug *o*. The front face of the newel *c* shows the section of the face string *# 4* at *q*, and the outside of the newel *b* has a lug *r* to which the well fascia *t* is bolted. The second newel base on string *# 4* has a lug shown at *u*, Fig. 36 (*a*), cast on the outside to receive the end of the face string *# 5*. The end of string *# 4* is bolted to the lug *g* on wall string *# 2* [see Fig. 36 (*c*)]. The face string *# 5* has the third newel base cast with it, and extends through to the wall string *# 3*, to which it is bolted. The lower end is bolted to the lug *u* on the second newel base. On the third newel is cast a lug *v*, to which face string *# 6* is bolted at its lower end. Face string *# 6* has the base of the fourth newel cast on it, and the lugs are practically the same as those shown in the detail.

The next pieces that demand attention are the risers. It will be noticed by referring to the plan, Fig. 36 (*a*), that

there are five kinds of risers, and that each is indicated by a number commencing at seven and ending with eleven; these risers are the same as in the first example, and have been described, except those marked *# 9*, which have a lug cast on the back at the center to carry the outer end of the light beam *# 13*, which aids in the support of the platforms. The fascia *# 12*, a section of which is shown at *t* in Fig. 37 (*e*), has ribs cast 2 feet apart along the back to stiffen and support it, while clamps, which are bolted to the fascia with countersunk screw bolts, are hooked over the beam. A detail, Fig. 37 (*f*), shows a perspective view of the string and base of the newel, with the flanges to receive the treads and risers. In the detail shown in Fig. 37 (*g*), *w* and *y* are sections of the face and wall strings, showing the moldings of each, the position of the slate treads, and the flanges supporting them. The railings include *# 14*, *# 15*, *# 16*, and *# 17*, shown in Fig. 36 (*a*), and are the same as those shown in Figs. 33 and 34.

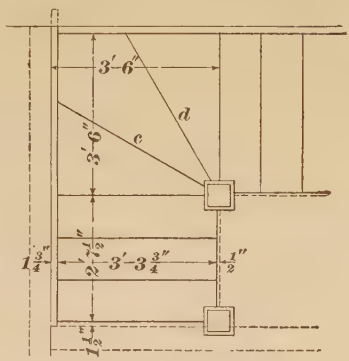


FIG. 38

It often happens that it is necessary to introduce winding

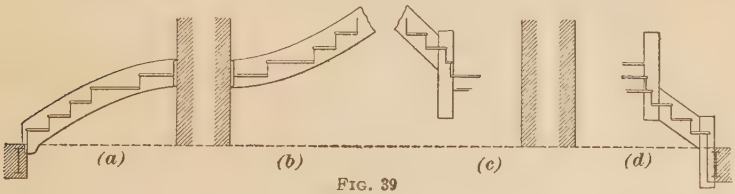


FIG. 39

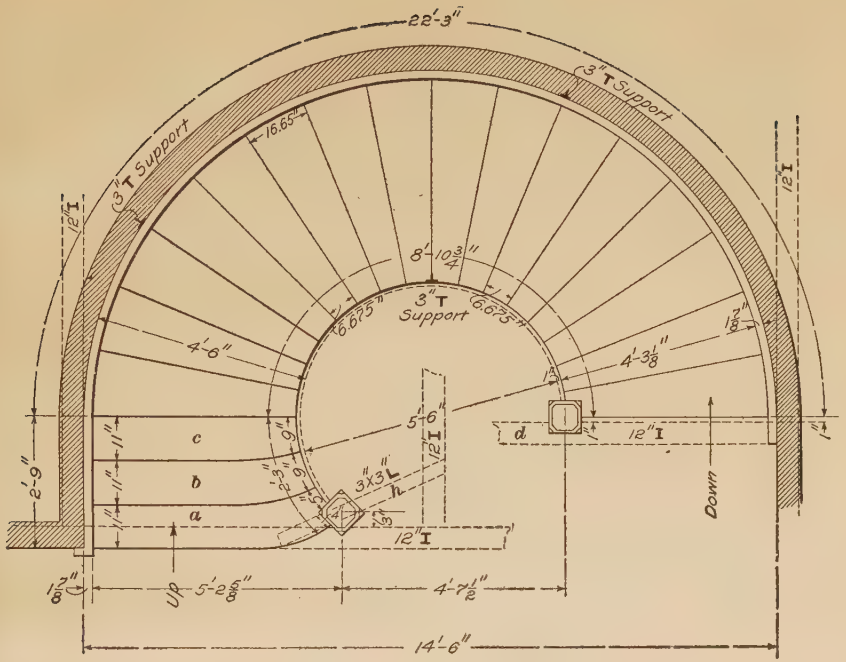
treads in the angles instead of straight platforms. For example, had the distance between the partitions in Fig. 36 been but 11 feet 4½ inches instead of 14 feet 10½ inches, the treads might still have been kept 10½ inches in width by planning the corners as shown in Fig. 38. In this case, the strings would take a curve that would be determined by the

intersection of the treads and risers with the wall string. The elevation of these curves is shown in the section in Fig. 39 (*a*) and (*b*). The only other detail affected by the difference of conditions would be the increased length of the newels brought about by the winder risers *c* and *d*, Fig. 38, having their start at the newel, thereby lengthening it by their height, as shown in the section in Fig. 39 (*c*) and (*d*).

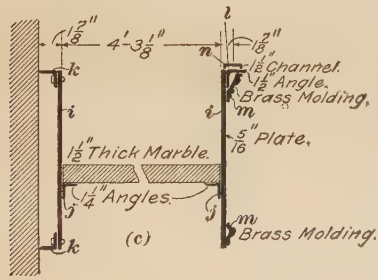
SEMICIRCULAR STAIRS

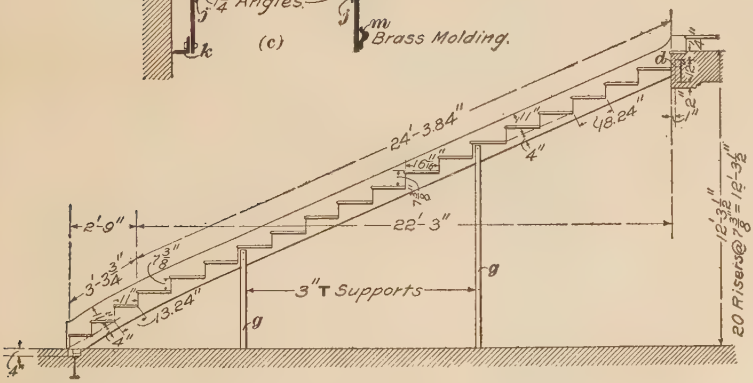
36. In Fig. 40 (*a*) is shown the plan of a semicircular stairway; at (*b*), the development of the wall string; and at (*c*), the section through the strings; while in Fig. 41 (*a*) is shown the front elevation; at (*b*) the development of the face string; and at (*c*), a detail of the rail on the upper landing. The first three treads *a*, *b*, and *c* of the plan, Fig. 40 (*a*), are 11 inches wide, and the remaining ones are so spaced as to be wider than this, if measured on a line midway between the strings. The diameter of the well is 14 feet 6 inches; and, deducting twice the distance from the wall to the center of the treads, it will be found that the diameter of a circle drawn through the center of the flight is 9 feet $11\frac{1}{8}$ inches, or 119 inches, which, multiplied by 3.1416, will give for the circumference 373.85 inches. Dividing this by 2 and deducting from the result 1 inch (the distance from the top riser to the beam *d*) gives the length of the center line required as 185.92 inches. This divided by the number of treads determines the width of each tread on that line to be $11\frac{5}{8}$ inches. The lengths of the strings around the outer and inner circumferences are taken on the inside faces, and are determined in the same manner. In a stair of this character, it is not possible to make sections through any particular part in such a way as to be of any service, but the development of each string is given instead.

37. To lay out a plan of a flight of stairs of this kind, begin with the wall string and lay off from the foot of the flight the first three treads 11 inches wide, and the other


22'-3"
3" T Support
3" T Support
16.65"
12" I
12" I
8'-10 3/4"
3" T Support
6.675"
6.675"
4'-6"
4'-3 1/8"
1 1/2" L
5'-6"
12" I
d
12" I
1"
2'-9"
11"
11"
11"
c
b
a
2'-3"
9"
3"
3 1/3" L
h
12" I
Down
1 7/8"
Up 5'-2 5/8"
4'-7 1/2"
14'-6"

(a)


l
7/8"
4'-3 1/8"
n
7/8"
1/2" Channel.
1 1/2" Angle.
Brass Molding.
k
i
i
m
5/16" Plate.
1 1/2" Thick Marble.
1/4" Angles.
j
j
m
Brass Molding.
k
(c)


24'-3.84"
48.24"
4"
16 1/2"
7 1/2°
2'-9"
22'-3"
3'-3 3/4"
7 3/8"
13.24"
4"
3" T Supports
g
g
d
12"
2"
1"
12'-3 1/2"
20 Risers @ 7 3/8" = 12'-3 1/2"

(b)

FIG. 40

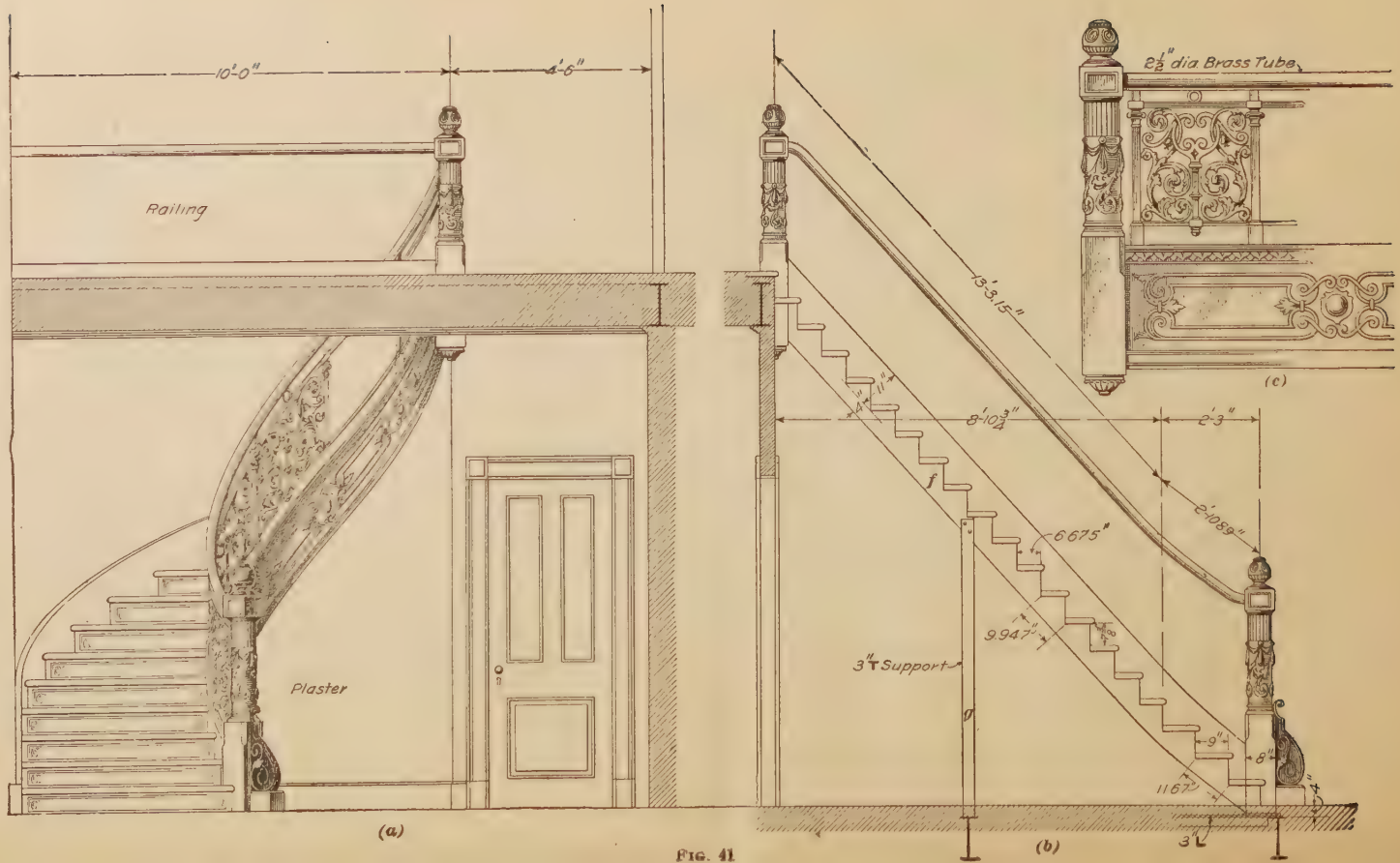

10'-0"
4'-6"
Railing
Plaster
(a)
2½" dia Brass Tube
(c)
13'-3 15/16"
8'-10¾"
2'-3"
2'-10⅝"
6675"
9.947"
3" T Support
9"
8"
11.67"
3"
(b)

FIG. 41

sixteen will be 1 foot $4\frac{1}{16}$ inches, the latter dimension being found in the same manner as the width on the center line and used in the development of the string, as shown at (*b*). A line drawn through the lower intersections of the treads and risers will form a basis from which to determine the width of the wall string and to lay off the top and bottom lines of this string, as shown in Fig. 40 (*b*). The proportion of the treads to the risers in the short straight part of the string is 11 to $7\frac{3}{8}$, while that of the curved portion is $16\frac{1}{16}$ to $7\frac{3}{8}$, thus causing the string to take a different angle; the juncture of these two parts should be eased off instead of showing the sharp angle, which would be out of harmony with circular stairs. This applies only to the wall string, as in the development of the face string, shown at *f* in Fig. 41 (*b*), there is a surface that is curved throughout its entire length. These curved strings are usually made of wrought-iron or steel plate that is capable of being bent to the required curve, and this bending is done by hammering on a curved block if the material is light, or by mechanical pressure in case of heavy work.

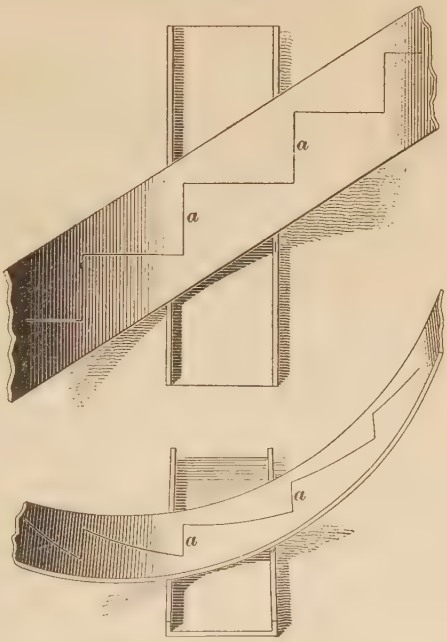


FIG. 42

38. With the exception of the straight part at the bottom of the wall string, both strings are helical in shape; that is, they take the form of a ribbon spirally wound around a cylinder and rising at a certain ratio.

To get this helical shape, the strings are first laid out flat, as shown in the developments, Figs. 40 (*b*) and 41 (*b*), with the lines of the treads and risers drawn on them; they are then laid across a block with the lines of the risers *a*, Fig. 42, parallel to the sides of the block, and while in this position are hammered or subjected to pressure every few inches. A wooden templet with one edge curved to the radius to which the string is to be bent is used to test the string and determine when it has been pressed to the proper curve. This templet is placed against the iron at short intervals, and held in a direction parallel to the lines of the treads. This bending may also be accomplished by passing the string in an angular direction through a set of rollers, provided they are long enough; this method, however, is seldom used, owing to the great length of roller required.

39. In making the pattern for the railing, it is advisable to first prepare a wooden drum of the same diameter as the stair well, on which the steps are laid out; and from them the top line of the string is obtained, which is also the bottom line of the railing. The top and any intermediate lines of the railing are then found by measuring perpendicularly from any point on the string line or from the center of each tread; and the whole railing may be either modeled directly to the proper curve or made straight and bent to the curve afterwards. The well holes of all stairs are framed before the stairs are built, and in straight stairs there is little more required in the shape of structural support; in curved stairs, however, it is often necessary to introduce special supports, as has been done in this case by the upright **T** irons *g* shown in Figs. 40 (*b*) and 41 (*b*). The circular partition under the string in this case is of terra-cotta blocks, and is therefore in itself incapable of affording sufficient support to the wall string. The strings should rest on the top of the floor-beams below, and should be bolted to the webs of the floorbeams above wherever possible; but, as this cannot always be done, diagonal bearings, such as shown at *h*, Fig. 40 (*a*), should be provided between the nearest beams.

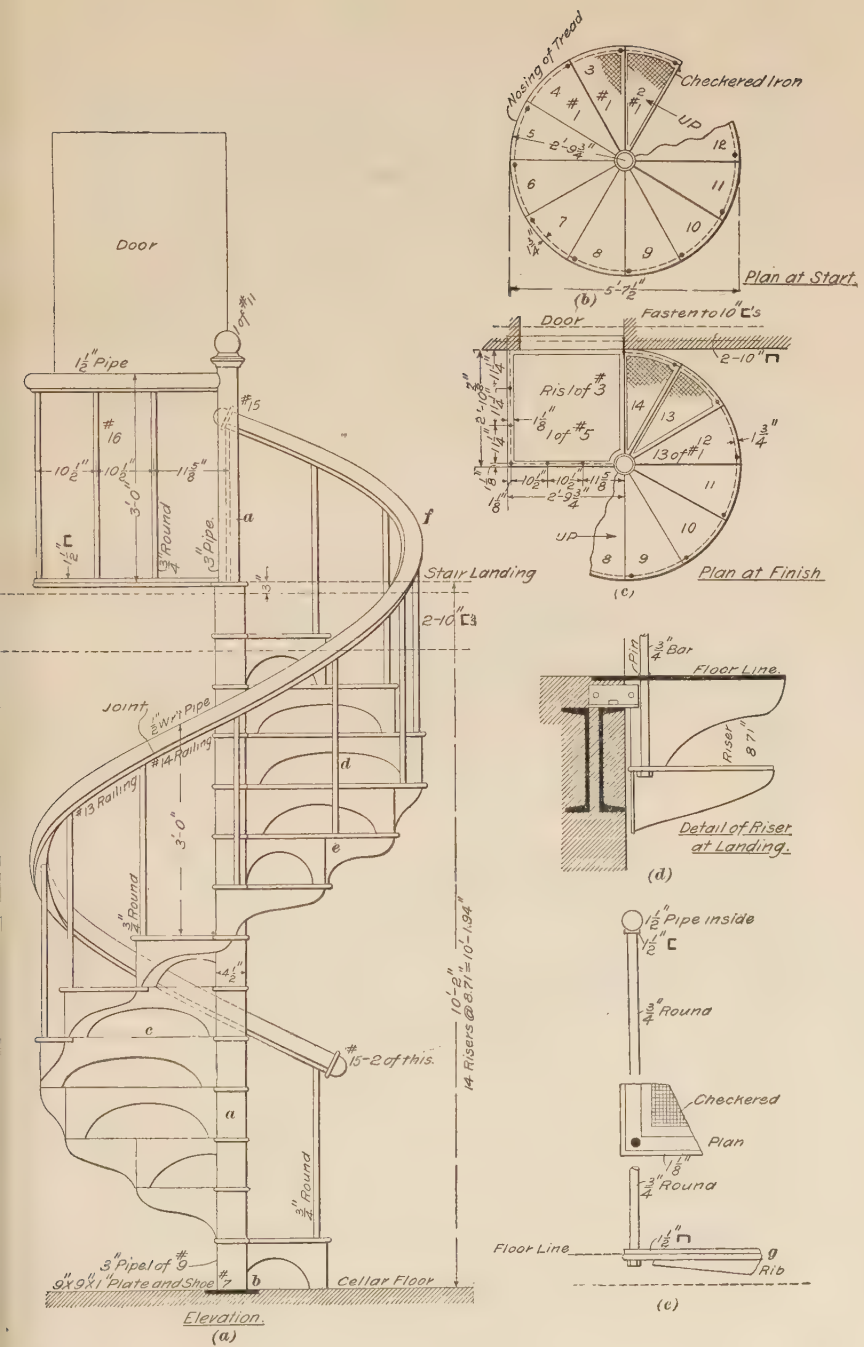

Door
1½" Pipe
#16
#15
1 of #11
10½"
10½"
11⅝"
3'-0"
¾" Round
2" Pipe
a
f
Stair Landing
2-10" C's
Joint
2" Wr't Pipe
#14 Railing
#13 Railing
d
e
3'-0"
¾" Round
4½"
c
#15-2 of this.
a
¾" Round
3" Pipe of #9
9"x9"x¼" Plate and Shoe #7
b
Cellar Floor
14 Risers @ 8.71" = 10'-1.94"
10'-2"
Elevation.
(a)
Nosing of Tread
Checkered Iron
UP
#1
#2
#3
#4
#5
#6
#7
#8
#9
#10
#11
#12
2'-9¾"
5'-7½"
Plan at Start.
(b)
Door
Fasten to 10" C's
2-10" C
Riser of #3
1 of #5
13 of #1
#13
#14
2'-9¾"
1⅛"
1¼"
1¾"
Plan at Finish
(c)
Pin
¾" Bar
Floor Line.
Riser
8.71"
Detail of Riser at Landing.
(d)
1½" Pipe inside
1½" C
¾" Round
Checkered Plan
⅛"
¾" Round
1½" C
Floor Line
g
Rib
(e)

FIG. 43

40. The face string being of wrought iron, it must be bolted to the newel faces, and in view of this, flanges are cast on the newel bases for this purpose. The constructive details for these stairs in the connections, with the exception of the strings, are the same as in Fig. 36. These strings are shown at *i*, Fig. 40 (*c*); the treads are supported on wrought iron angles *j* bolted to the string. The top and botton angles *k k* of the wall string and the top angle *l* of the face string are of angle irons riveted to the string. The upper and lower edges of the face string are finished with brass molding *m*, and the balustrade is first secured to the channel iron *n*, which in turn is bolted to the string.

CIRCULAR STAIRS

41. A type of circular stairway, similar to that described in *Architectural Drawing*, is shown in Fig. 43. This stairway is suitable in some such position as an engine room, from a sidewalk to a subcellar, or from an attic to a dome, or tower, or in any position where space is limited. The construction is of the simplest character, and consists of a central core or wrought-iron pipe *a* resting on a plate *b* at the bottom. The treads and risers *c* are of cast iron in one piece, with a collar to fit over the pipe *a*, so that in erecting the stair the risers and treads are slipped on as shown in Fig. 44. In order to keep them in place, the upright bars of the railing *d*, Fig. 43 (*a*), are continued down through each tread near the front edge to a lug, or projection, *e* on the back of the tread immediately

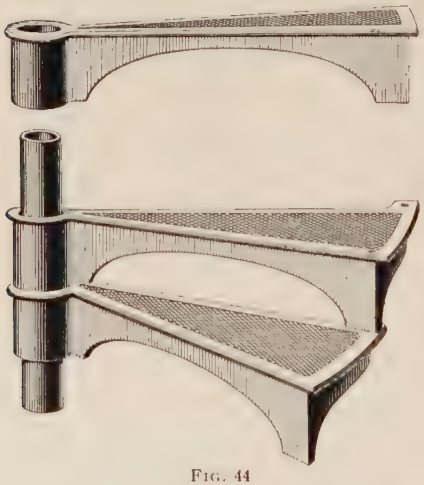


FIG. 44

underneath, and are secured with a nut. The top riser acts as a brace to hold the pipe in place, and is fastened to the beam with a wrought-iron strap of any suitable shape. There are no strings to be bent in these stairs, but the hand rail *f* must be bent to the proper curve. This rail is composed of a small channel iron with a $1\frac{1}{2}$-inch wrought-iron pipe on top.

42. To bend any bar or pipe, the most satisfactory results are obtained by using rollers, preferably run by power, as shown in Fig. 45, one of these rollers being capable of adjustment, so that the pipe or bar may be bent to any required radius. In this way, not only is it possible to give the hand rail the necessary curve, but, as the amount of

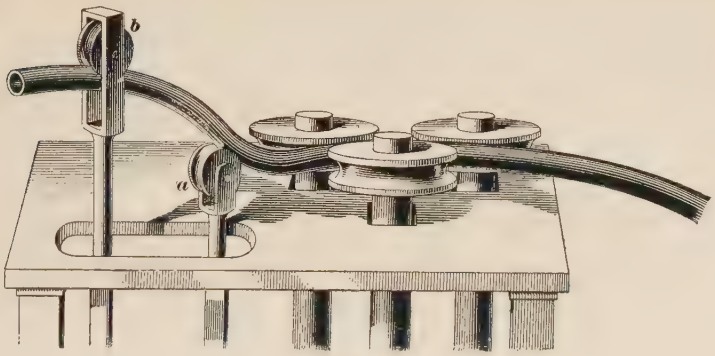


FIG. 45

rise per foot is known, it can be given this upward direction at the same time by setting the gauges, or guides, *a* and *b* to the proper angle. It is presumed that the stair is erected before the hand rail is bent; and to determine if the rail has been bent to the proper curve, it is laid over the top of the steps, and corrected by hand if necessary.

It might, however, be required that the hand rail should be bent and set quite independently, and assuming that the rail were a flat bar, $1\frac{1}{2}$ in. $\times$ $\frac{3}{8}$ in., it would be accomplished as follows: An end view of a tread and riser would be laid out in outline, the sizes being taken at the center line of the railing, as shown in Fig. 46 at *b*. A part plan of the stairs, showing two treads, would then be drawn, as *e a* and *a f*, with

a dotted line $c\,d$ through the points e, f where the tread lines intersect the outline of the stair plan. Then, from a as a center, and with a radius equal to b (the true length of the rail over each step), arcs would be struck, intersecting the line $c\,d$ at points g and h, which points are located on the true curve of the rail. A circle described through the points g, a, h would give the curve to which the hand rail should be bent. The bar is then bent to this new radius and twisted evenly along the whole length of the stairs in the manner and with the tools shown in Fig. 47. It will be found that the whole bar has now the form of a helix, and is of the required radius. Before being twisted, the positions of the balusters should be marked on the bar, and the holes for them bored or punched, as the case may be.

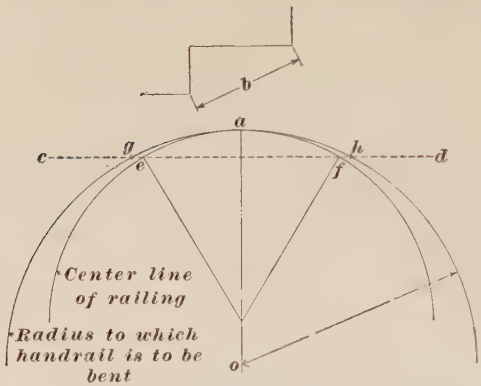


Fig. 46

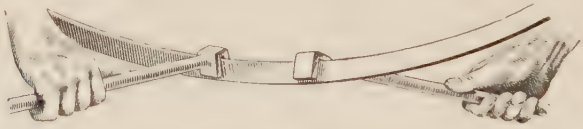


Fig. 47

43. In Fig. 43 (*b*) and (*c*), are two plans, one showing the start at the cellar-floor level and the other the finish of the stairs at the platform. The detail of the connection at the platform, the method of securing the baluster through the tread, and details showing the corner of the platform and the pipe forming the rail are shown at (*d*) and (*e*). The platform is strengthened by the ribs *g* cast on the under side, as shown at (*e*).

FRIEZES AND BALUSTRADES

44. Friezes.—In Fig. 48 is shown a cast-iron frieze. The ornament is bold, and has considerable relief, but being entirely on the surface and not undercut, it does not present any special difficulty in molding, and the model may be

FIG. 48

withdrawn from the sand without injuring the ornament. The modeling of this frieze should be in clay and then cast in plaster, and the working mold should be cast from this plaster model in the same material.

45. Balustrades.—Figs. 49 and 50 are examples of stair balustrades or panels. Figs. 51 and 52 are examples suitable for exterior or exposed positions. The newel *a*, Fig. 49, is modeled, molded, cored, and cast in the same manner as the one already described. The balusters *b* are carved in wood and cast *solid*. They are secured with countersunk tap bolts at the bottom and top to an iron strap or rail *c* and *d* $\frac{1}{4}$ inch thick, and of a width equal to the baluster base, or to a channel iron.

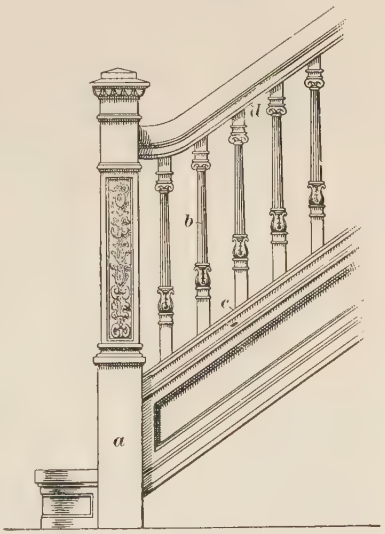


FIG. 49

The characteristic features of the design shown in Fig. 50 are the cartouch *a* at the center of the panel, the trident *b* that pierces it, the dolphins *c* that act as supporters, and the

scrolls *d*, which complete a very rich and artistic panel. This design for a stair rail is especially good, as it fills the void between the string and the rail, affording perfect protection, while at the same time the design is not overloaded with ornament and is very well constructed.

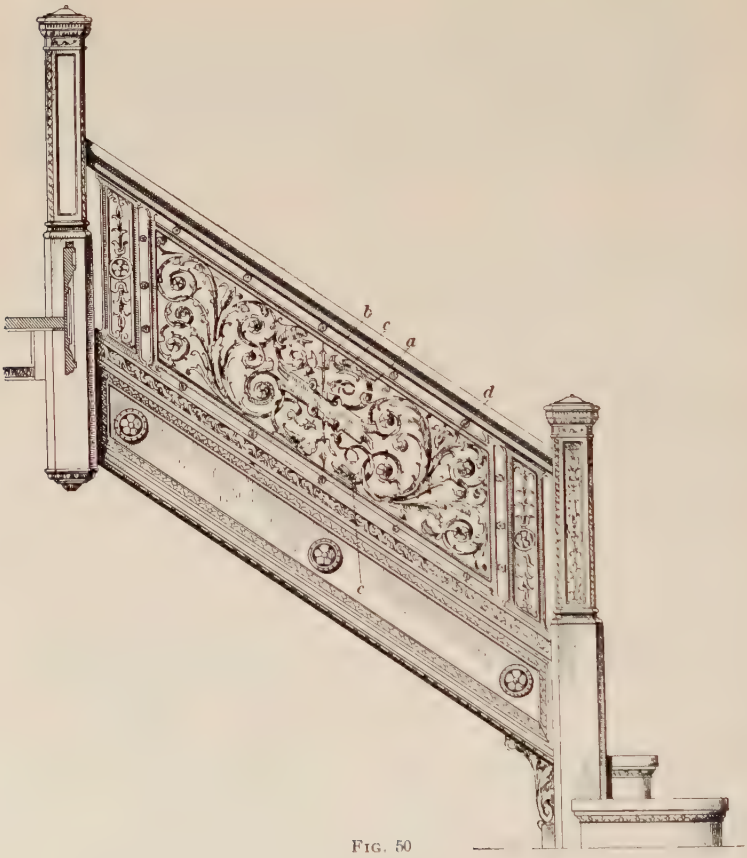


FIG. 50

The features of the railing shown in Fig. 51 are the long and the short panels forming its divisions. The large panels are strengthened and braced vertically at the middle with a post *b* running from the top rail to the lower rail, and horizontally with the rails *c*, *d*, and *c*. The short panel *f* is

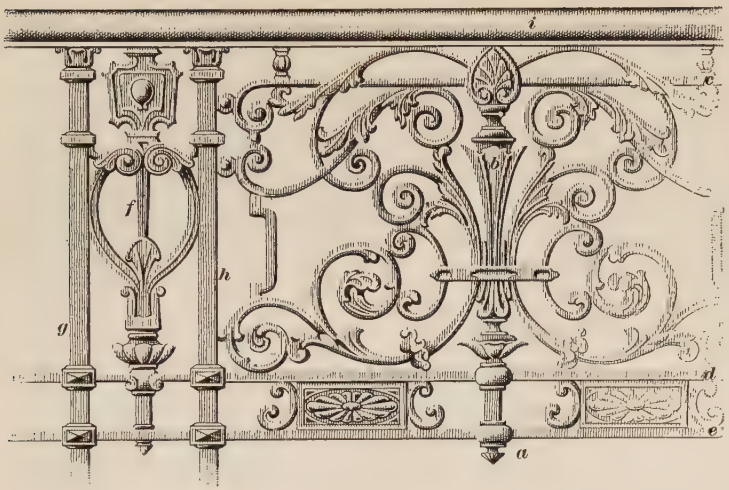


FIG. 51

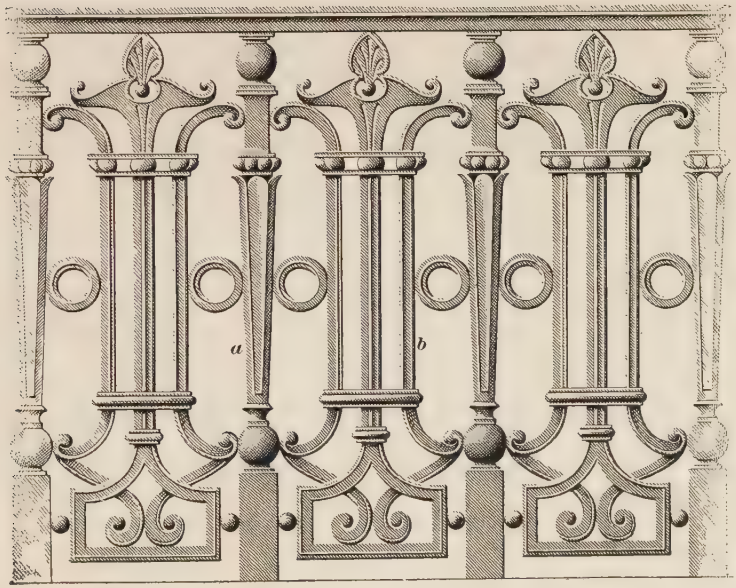


FIG. 52

let in between the posts *g* and *h*, combining them. The hand rail *i* is made of a brass or bronze pipe.

The rail shown in Fig. 52 is composed of a series of balusters *a* with panels *b* let in between them. The panel is well secured at four points on each side. The hand rail is formed of iron with a molded cap piece screwed on.

46. All of the foregoing stairs are such as might be used in ordinary office buildings or hotels, and having mastered the constructive details of these examples, it is possible to design any stairs, no matter how elaborate or massive. The character of the stairs should, of course, harmonize with the surroundings, and the principal flight, starting in the main hall, is often made a feature of the architecture by being of ample width and large proportions. The newels also can be treated in a special manner, and possibly the strings may be of wrought iron faced with ornamental cast iron. If the stairs are over 5 feet in width, it is necessary to introduce intermediate strings or supports to carry the load. Fig. 53 shows a florid design for a starting newel, which might properly be used for an important stairway.

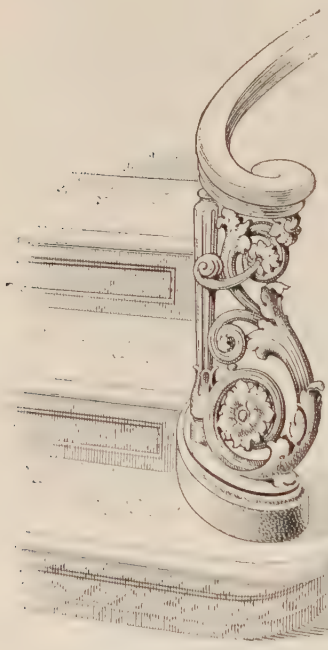


FIG. 53

Fig. 54 is reproduced from a photograph of a staircase with adjoining elevator enclosures. This is a good example of the style of stairs used in a typical office building. The effect of the decoration on the newels and strings and the repeating of the baluster panels of the stair railing are particularly good.

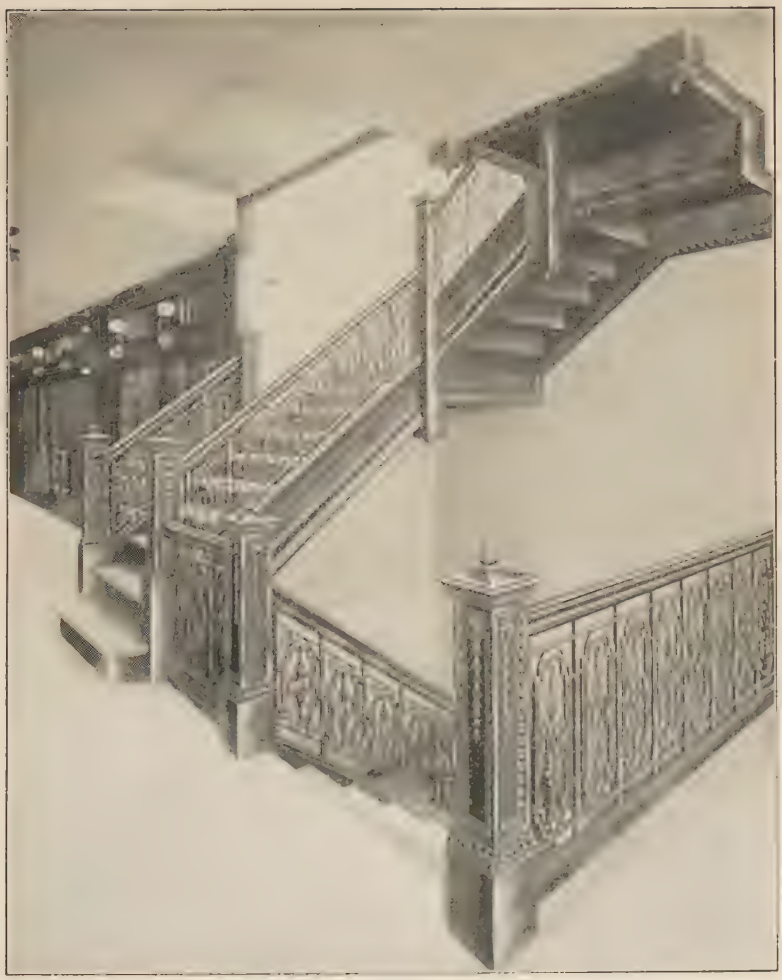


Fig. 54

BRONZE WORK

INTRODUCTION

47. Bronze.—The material known as **bronze** differs from iron in being an alloy of copper, tin, and zinc. It is softer and richer in appearance, and possesses many qualities that make it one of the most valuable metals for certain purposes. As bronze does not rust like iron, it may be used in conjunction with fine stone or marble without any danger of causing discoloration. It is capable of being finished in many ways, and its appearance, instead of becoming impaired, improves with age. The process of casting bronze is very similar to the process of casting iron, except for statuary and work of a similar nature. Bronze, however, shrinks to a greater degree than iron, and for this reason greater allowance has to be made.

48. Finishing Bronze Casting.—The amount of time and skill that may be expended in finishing and chasing bronze is practically unlimited, but depends entirely on the article itself and on the position it is to occupy. A cornice or cartouch, say on the façade of a building at a considerable height above the ground should not be finished in the same manner as a counter screen for a bank, but, rather, it should be left somewhat rough, just as it comes from the sand, the effect being better. On the other hand, when a fine finish is desired, it is filed and rubbed with fine emery and chased until almost every part of the surface has been carefully treated, the difficulty often being to decide just at what point to stop. Many fine castings are robbed of all character by overdoing the finishing.

Bronze and iron can be worked in a somewhat similar manner, except that bronze does not act in quite the same

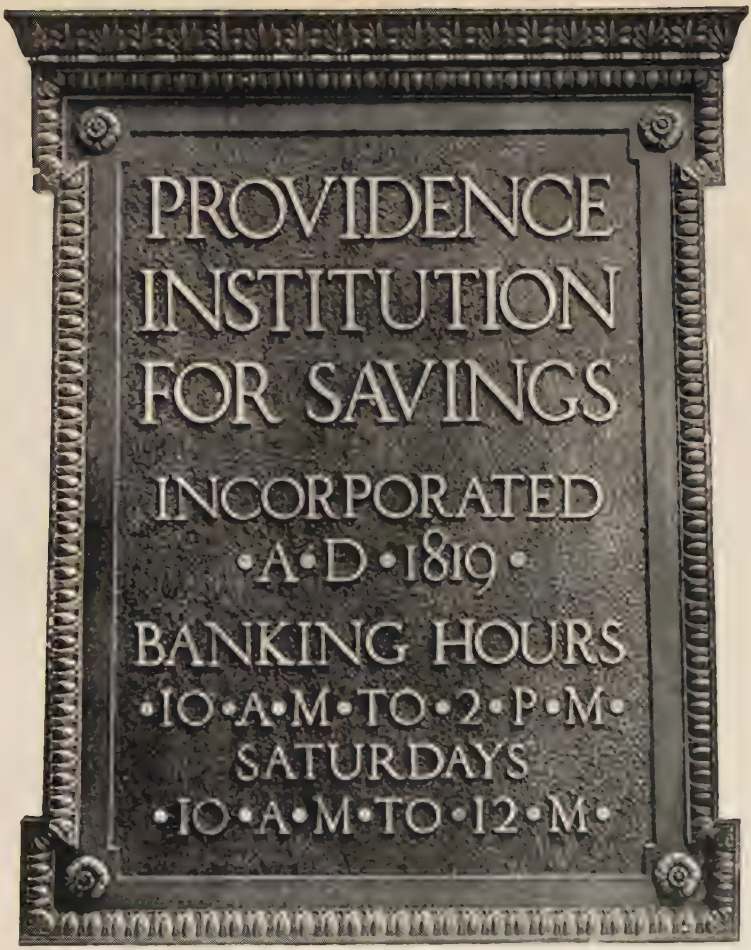

PROVIDENCE
INSTITUTION
FOR SAVINGS
INCORPORATED
•A•D•1819•
BANKING HOURS
•10•A•M•TO•2•P•M•
SATURDAYS
•10•A•M•TO•12•M•

FIG. 55

manner as iron when subjected to heat; it also presents difficulties that have to be overcome by repeated heating and careful working. Hammered work is done cold, the same as iron, but as bronze is softer and more ductile, it is easier to work.

EXAMPLES OF BRONZE WORK

49. Tablets and Cartouches.—Bronze is largely employed in the forms of moldings, capitals, and bases of columns, tablets, cartouches, etc. Fig. 55 is a design for a plain memorial tablet cast in one piece; or, if preferred, the letters may be made and applied separately. These tablets are usually fastened to brickwork or stonework by means of

Fig. 56

bronze expansion bolts with flat countersunk screw heads, which are tapped and covered with a rosette or button that screws into the hole in the bolt head.

Fig. 56 is a cartouch somewhat after the Italian Renaissance style, and marks the middle point of the frieze on which it is set. Possibly it might be placed over an entrance or on one of the stone piers of a building or any similar spot. The modeling may either be in very low relief or project boldly. If the latter, it is likely that the hollows would be undercut, and proper arrangements for this should be made in the pattern.

FIG. 57

50. Bronze Capital.—Fig. 57 represents a large Grecian Corinthian capital elaborately undercut, almost every separate member standing out free from the body. This body, or central part, is made separately as is also the abacus, and the individual scrolls and leaves are mounted on it one after the other. As a matter of fact, the whole capital

FIG. 58

could be cast in one piece if necessary or desirable, but would involve considerable expense and risk; therefore, the best plan would be to build it up in a number of units.

51. Brackets and Lamps.—Bronze work as applied to lamps and brackets is susceptible of very beautiful treatment, of which Fig. 58 is a striking example. This figure illustrates one of a pair of lamp brackets in the form of a griffin

Fig. 59

FIG. 60

Fig. 61

with outstretched wings and bearing the globe depending from its jaws. The combination of utility and beauty are well worked out, in that the bands around the globe are kept entirely on the upper part so that the light is not obstructed in a downward direction, where it is most desirable. The whole pose of the body is strong, and the effect is brisk and lively.

Another beautiful design having the shape of a torch supported from the wall on two straight arms is shown in Fig. 59. This design is totally different from the preceding one, as it is almost purely decorative. The element of light is used only as part of the general scheme. The light is surrounded by a skeleton globe with an equatorial band on which are the signs of the zodiac. It was designed for the office building of the American Geographical Society.

52. Lamp Column.—In Fig. 60 is illustrated another type of lamp, being a standard or column rising from a base and resting on a stone block. The modeling of the acanthus leaves and the trailing vine is exceptionally good, as are also the general proportions.

53. Newels.—Fig. 61 shows the starting newel and part of the railing for a marble stairway suitable for a bank or private residence. The effect of the curved newel with the trailing leafwork circling around on top of the marble base adds greatly to the appearance of the hall in which the stairway is placed.

A similar effect is shown in Fig. 62. The design in this case is marked by great solidity and massiveness. The stair string here is also of bronze, although the weight of the stairs is borne by a steel beam or channel behind the bronze string, being concealed by the string and the marble work.

The character of the design in both examples is determined by the hall, which in the former case is comparatively small and dainty and in the latter, lofty and spacious.

54. Elevator Screens.—Fig. 63 shows a bronze elevator screen, the transom grille being designed to contain the dial indicator, which shows the movement of the elevator car as

FIG. 62

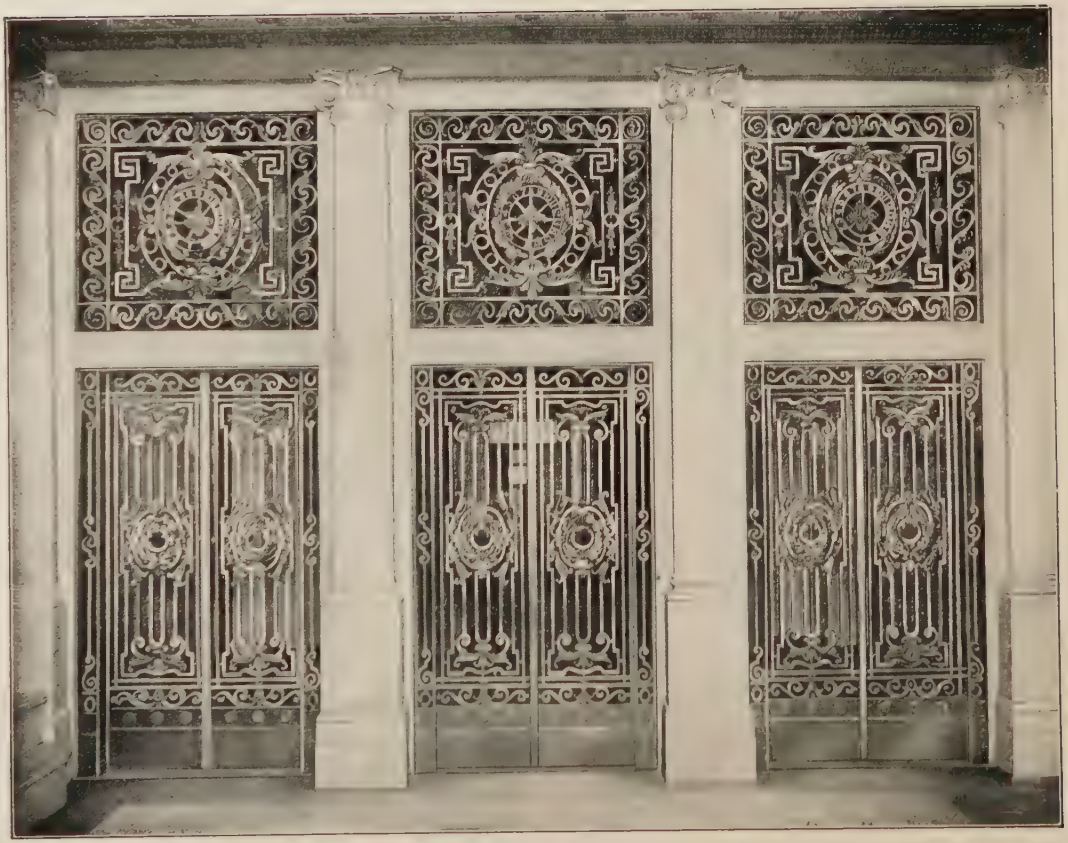


FIG. 63

FIG. 64

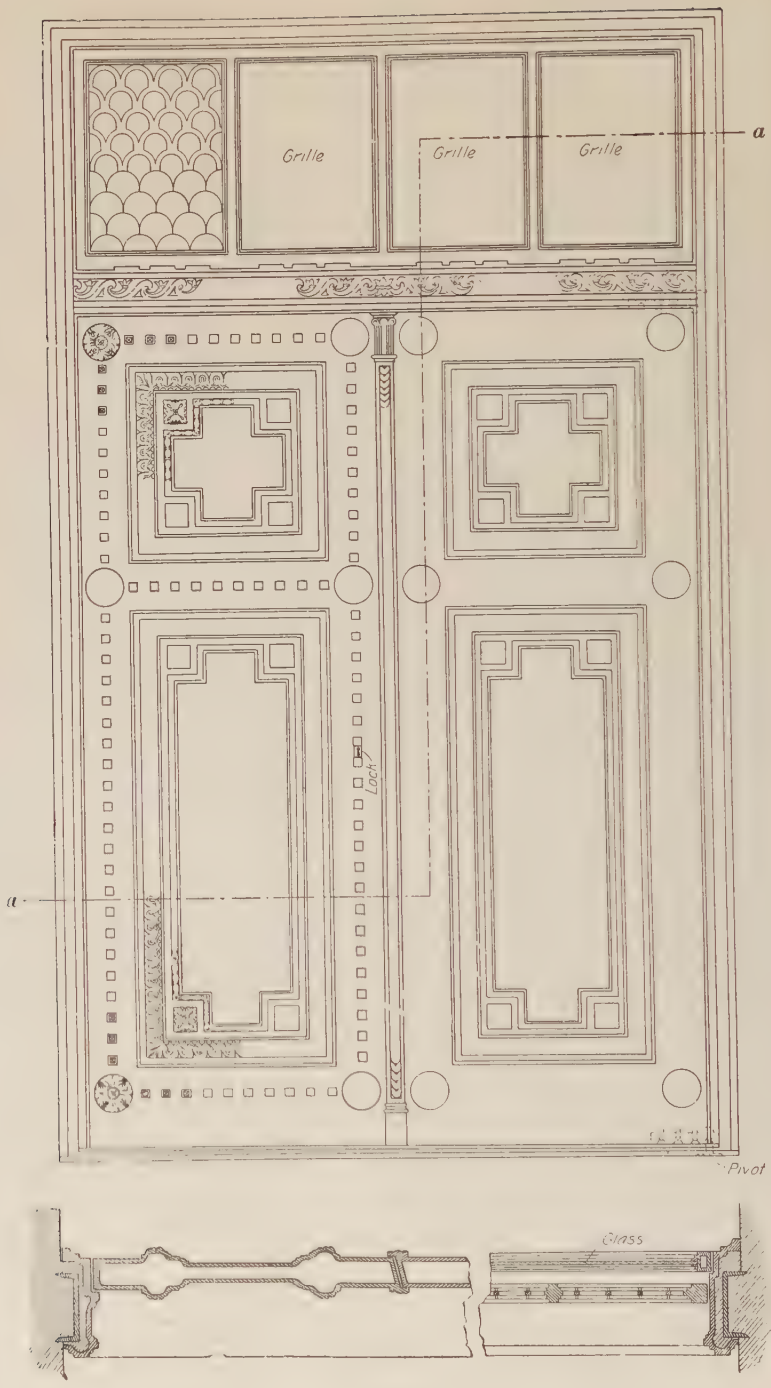


FIG. 65

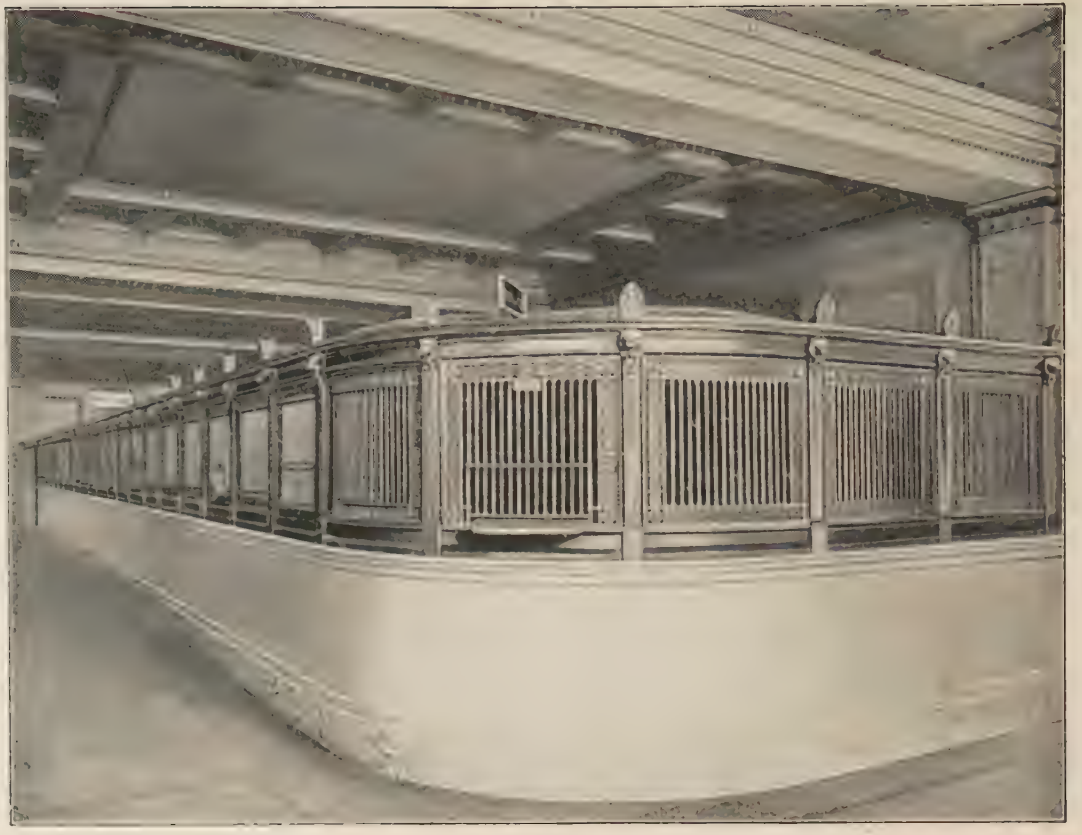


FIG. 66

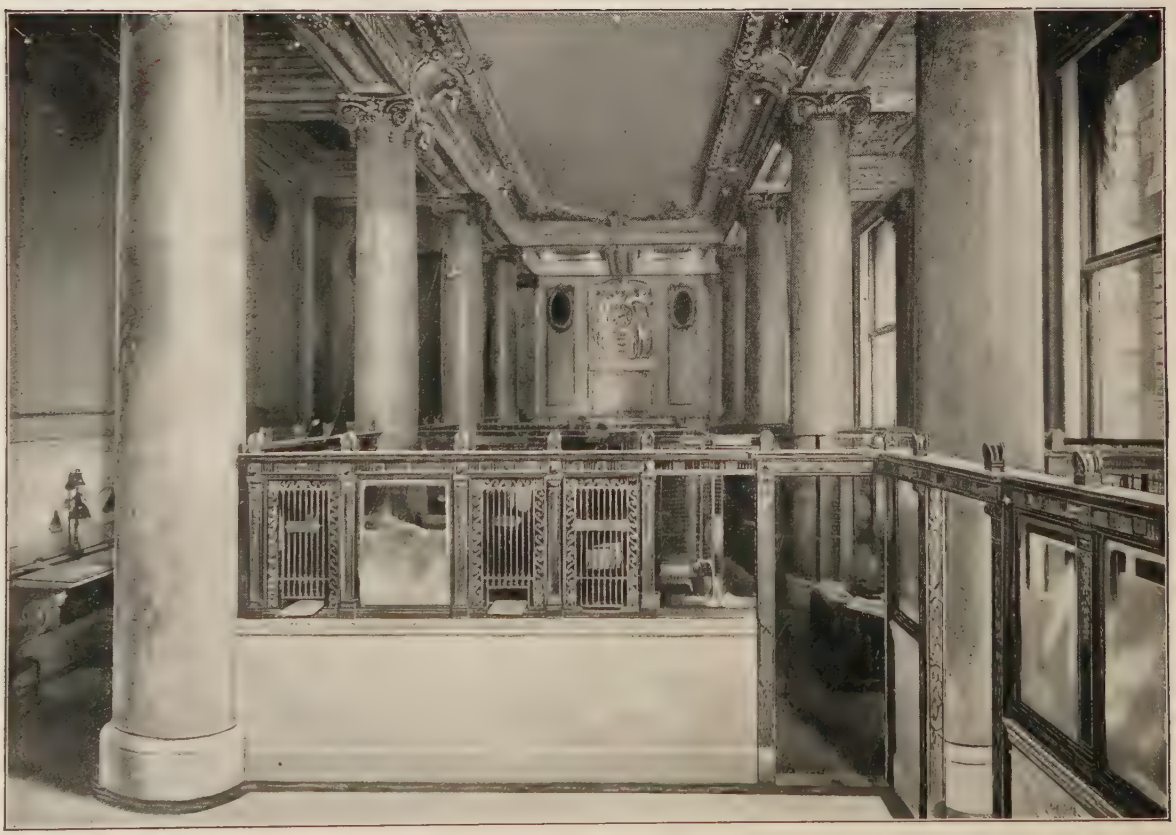


FIG. 67

it travels up or down. This design is for a combination of wrought and cast bronze, the straight bars being wrought and the scrolls and leafwork cast.

This screen could just as well be made of either all wrought or all cast bronze. If of the latter, however, the work of filing and finishing the straight bars would be greater, and the result would not be so satisfactory. As to which parts of any design shall be cast and which wrought, is to a great extent a matter of expediency, the artisan using his own judgment as to what is most convenient.

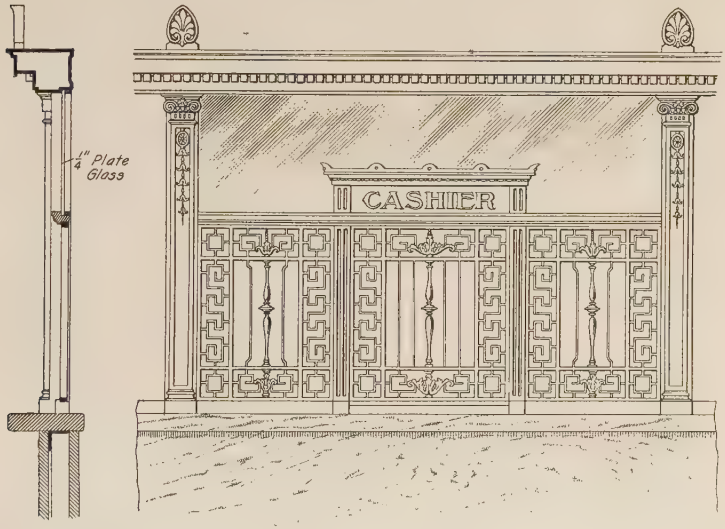


Fig. 68

55. Doors.—Entrance doors are made of bronze in many designs, depending on the style of the building in which they are to be used. Some are in grille form with glass panels, and others are solid, like Fig. 64, with the upper panels glazed. They may be cast or built up out of sheet bronze planted on a wooden core or on an iron or bronze skeleton frame, in which case the moldings and ornaments are applied separately. The fitting and jointing should be carefully done, so that the work as a whole may look solid.

Fig. 65 shows a similar pair of doors, but with a transom light overhead, the glass being protected by a heavy grille. In order that the glass may be cleaned, it is set in a separate frame, which may be hinged at the top or bottom, or, if preferred, at the sides. This door is shown as a solid casting, but may be built up as before mentioned.

Fig. 69

56. Counter Screens.—Figs. 66 and 67 illustrate counter screens for banking rooms, and are designs of exceptional merit. These screens are made chiefly of cast bronze. In every case, the paneling is backed up with plate glass, which may be clear, frosted, or decorated in any manner desired. Fig. 68 shows another design in which the grille-work is lighter and is made of wrought bronze. The section shows how the whole screen is supported by a

skeleton wrought-iron frame concealed by the marble panels of the wainscot. The bronze posts have a wrought-iron rod running through them and bolted to the angle framework, in order to insure rigidity. The wickets in front of the officers' desks are, of course, hinged so as to open.

57. Telegraph Booth.—Fig. 69 shows a complete telegraph booth constructed of bronze and marble. The construction is somewhat similar to that of the counter screen. As the marble, being in slabs about $\frac{7}{8}$ inch thick, has very little bearing strength, the weight has to be carried by some kind of framework, preferably wrought iron.

As has already been stated, almost any of the iron examples may be made in bronze, the chief difference in execution being the amount of time expended in finishing the work.

ORNAMENTAL METAL WORK
(PART 2)

WROUGHT-IRON WORK

METHODS OF MANUFACTURE

CHARACTERISTICS

1. Wrought iron and steel differ from cast iron principally in the characteristics that they are soft, malleable, and fibrous, while the latter is hard, brittle, and crystalline. This difference in character is due to the method of manufacture, as both kinds of material come originally from the same ore. Wrought iron and steel are purer than cast iron, as phosphorus and sulphur are eliminated as far as possible, as well as other ingredients that abound in cast iron. It is the carbon that gives cast iron its hardness, and the phosphorus that makes it brittle, while the elimination of the sulphur renders wrought iron malleable and capable of being forged. While it is practically impossible to entirely eliminate these ingredients in the manufacture of wrought iron, they may be so reduced as to be harmless. The presence of too much phosphorus will render the iron what is termed **cold short**, that is, brittle, or liable to split or break when hammered or bent cold. Sulphur, however, does not so much affect the cold working of the iron, but if present in excess, it tends to make it **hot short**, or brittle at a red heat, and unweldable at any temperature.

The value of these characteristics will be better appreciated when the methods of working are described.

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TOOLS AND IMPLEMENTS

2. In some structural work, cast iron is used extensively on account of its cheapness; but for certain classes of work, cast iron is not suitable, and wrought iron is employed almost exclusively.

Ornamental wrought-iron work may be divided into two general classes; namely, that which requires to be fashioned while hot, and lighter work, which is manufactured from cold materials. In each case, the original material is in the same form—long bars of varying widths and thicknesses,

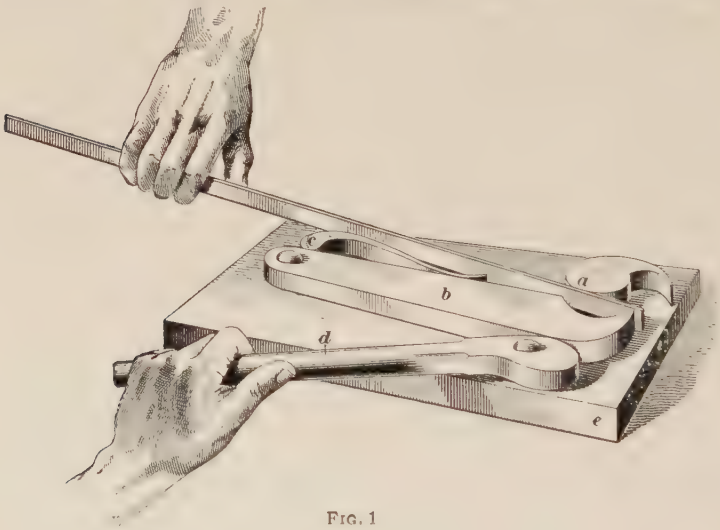


FIG. 1

which are worked with vise and pliers, or forged with hammer and anvil, into any desired shape. The dominating feature of some designs is frequently the repetition of similar scrolls or rings; and when there are a number of these, it is necessary that they should be produced rapidly and exactly alike.

In making any small scroll of light iron, the first and most important step is the forming of the small quirk, or curl, at the center; the method and machine for doing this is shown in Figs. 1 and 2. The tool employed is of a very simple

character, and consists of a templet *a*; a clamp, or die, *b*, which is pivoted at one end, the other end fitting over the templet; a spring *c*, which keeps the die clear of the templet; and a lever *d*, which forces the die into place. In Fig. 1, the lever is thrown back to allow the clamp to be pressed open by the spring *c*. The bar, the end of which is to be bent, is introduced between the templet *a* and the clamp *b*. The lever is then pulled forwards, forcing the die against the templet, and the beginning of the scroll is formed. The

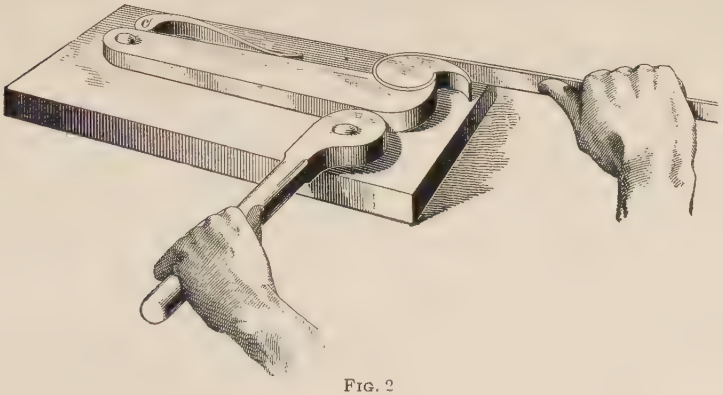


FIG. 2

bar is then brought around to the position shown in Fig. 2, and the first convolution of the spiral is completed.

3. The bar is now placed in the machine shown in Fig. 3, and the remainder of the scroll is formed. This machine consists of a shaft *a*, on which a screw thread is cut, and over which is coiled a steel spring *b*. On one end of the shaft is a crank, or handle, and on the other end the disk *e* carrying the coil, or volute, *f*, which forms the die, or pattern, for the rest of the scroll. This plate and volute are detachable, so that different sizes of scrolls may be formed on the same machine.

The bar, having had the first convolution of the scroll formed as already described, is now placed in the machine, as shown at *h*. The lever *g* is pressed against it to hold it in close contact with the volute *f*, and the disk is revolved until the scroll has assumed the proper number of convolutions.

As the shaft turns, the screw thread causes the disk to advance, and the bar *h* is coiled evenly in one plane, instead of conically, as might appear from the spiral on the disk. As the disk advances, the edge of the spiral in contact with

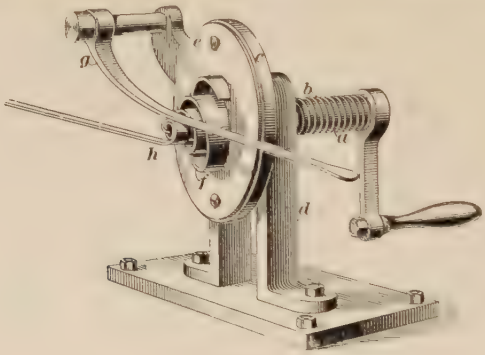


FIG. 3

the lever *g* is always in the same relative position. When the shaft has reached the point where the proper number of revolutions has been attained, a catch releases the nut from the screw thread, and the spring *b* throws the shaft and disk back to their original position, and releases the completed scroll, which is now cut off the bar, and another one prepared in the same manner.

With such appliances one man can make from 300 to

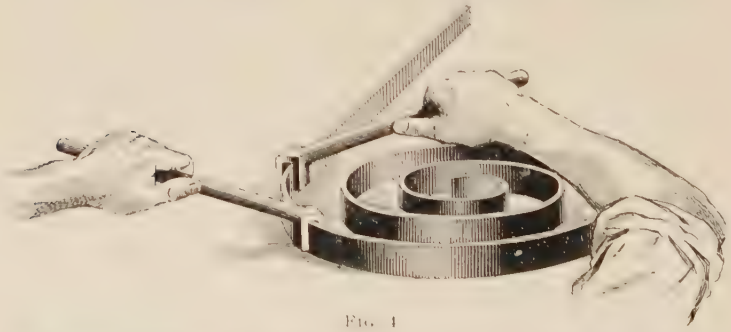


FIG. 4

600 scrolls in a day, according to their size and weight; but where only a few scrolls are required, it is usual to make them almost entirely by hand, for which tools similar to

those shown in Fig. 4 are used, the operation being so simple that description is not necessary.

4. As it is more economical to have special machines for the manufacture of scrolls in quantities, the same applies to the twisting of flat bars, and for this purpose the appliance shown in Fig. 5 (*a*) is used. This apparatus consists of a fixed upright *a*, with a socket to receive the pipe *b*, the other end of which rests in the movable upright *c*. The upright is arranged to travel along the bedplate by means of a threaded shaft *d*, so that the length of the pipe *b* may be

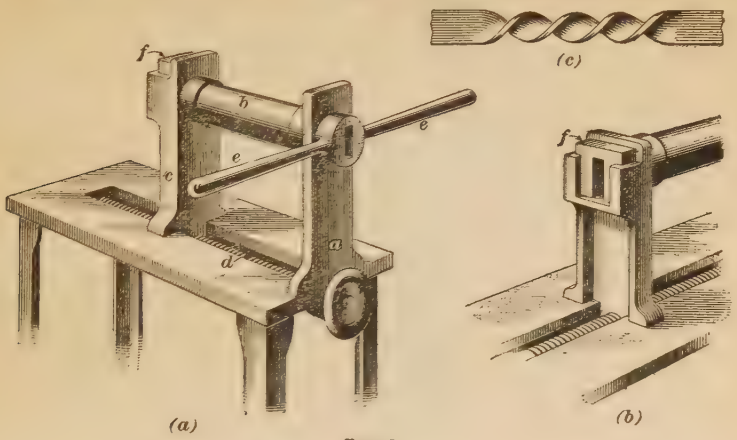


FIG. 5

changed to suit the length of the twist required to be produced. The bar to be twisted is passed through the pipe and the slot in the lever *e* until in proper position, after which the slotted piece *f* is dropped into the pocket, as shown in Fig. 5 (*b*). If the length of the pipe is such that the distance between the lever and the slotted piece is of the desired length for the twist, and the bar is then held at these two points and prevented from revolving independently, the lever can be wound around as many times as is necessary to produce the required twist. The greater the number of turns, the closer will be the twist. The piece *f* is made loose and dropped into place, so that it may be easily lifted out when the twist is completed, and thus allow the finished bar

to be withdrawn without twisting in through the slot, as would be necessary if the slots were permanently fixed in each end. The pipe *b* merely acts as a guide to prevent the bar from bending in a lateral direction when the twist is of considerable length.

5. The machine just described is for making a regular twist, as shown in Fig. 5 (*c*), but another form of twist in common use, especially in light grille-work, is made by giving the bar a series of half turns, as shown in Fig. 6.

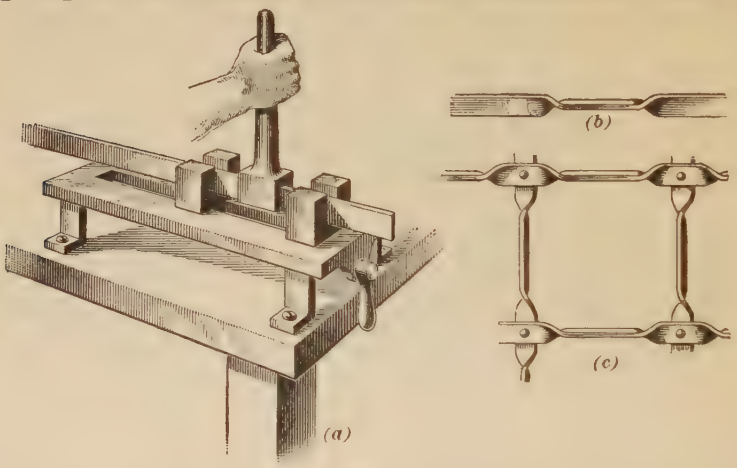


FIG. 6

The bar is dropped into two slots, as shown at (*a*), one of which can be adjusted by means of a long screw underneath the bedplate, so that the length of the part to be twisted may be regulated. It is then grasped between these slots by the loose clutch, and given a half turn, producing the result shown at (*b*). If the bar is to form a part of a square mesh grille, as shown at (*c*), there will be a number of these twists to each piece, and the distance from center to center should be marked out before the twisting is commenced. If the quantity required should be great, it might be advantageous to make a set of fixed pockets fixed to the proper centers, so that six or more turns could be made without lifting the bar.

The foregoing are a few of the tools used in the manufacture of light grille-work; where this class of work is produced to any great extent, however, there is a constant demand for new tools to meet the requirements of special conditions, but these tools cannot be bought and therefore must be made. It would be impossible to provide for the manifold variations that are likely to occur; but, apart from these special tools, those that are here illustrated are always in demand, and supplement the general machines, such as drills, punches, lathes, etc.

BAR ORNAMENTAL WORK

GRILLES

6. Simple Designs.—Having described the tools used in working wrought-iron bars into forms for grilles, a few examples of the simpler forms of grilles are shown in Figs. 7 to 10. These are plain basket patterns, and can be

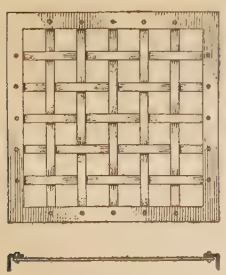


FIG. 7

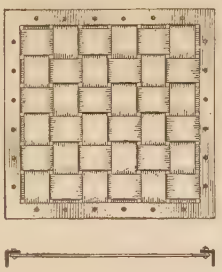


FIG. 8

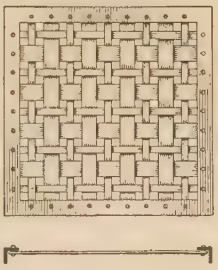


FIG. 9

made from any size iron and set to any mesh. The frames are of angle iron, the ends of the meshwork being riveted to them. The meshwork grilles, being of an interlaced pattern, form a strong and economical screen to manufacture. If the surface to be screened by this basketwork is considerable, it is desirable to place rivets at intervals throughout the mesh; otherwise, the metal strips that form the mesh are likely to slip out of place and become distorted.

If a more ornamental grille is wanted, the simplest variation is obtained by twisting the bars as shown in Fig. 11, the result being that a mesh is produced with the edges toward

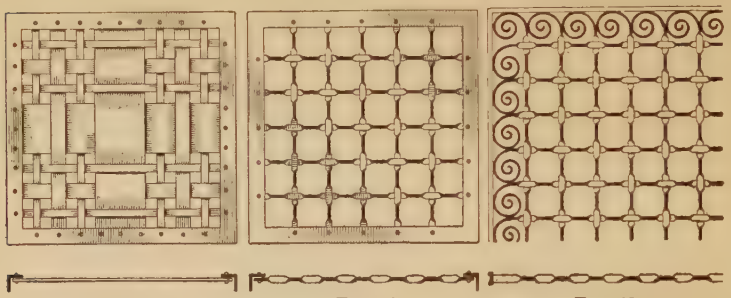


FIG. 10 FIG. 11 FIG. 12

the eye and a series of flat crosses at the intersections. If a border to this grille is desired, the scroll ornament shown in Fig. 12 is suitable and inexpensive; a glance at the illustration will show that this scroll is made by simply turning the ends of each strip or bar. In this case, an angle-iron frame could not very well be used, because part of the scroll would

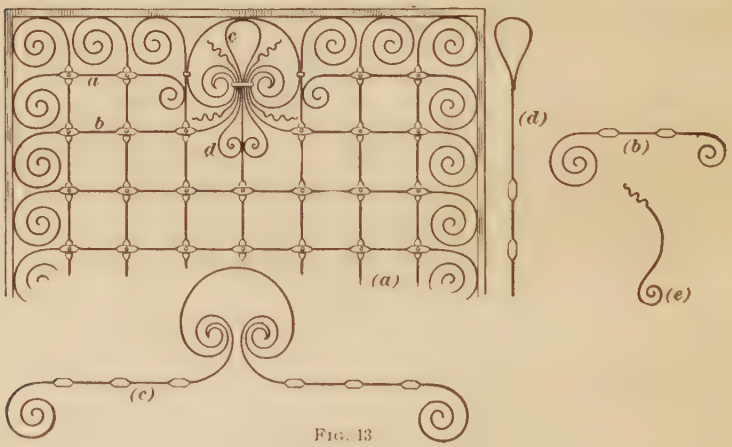


FIG. 13

be hidden by the flange of the angle. The frame may be a flat bar, though a small channel would be preferable, as the ends of the rivets that fasten the scrolls could be hidden in the hollow of the channel.

7. A great variety of grille designs have the square meshwork shown in Fig. 11 as a basis, with additional orna-

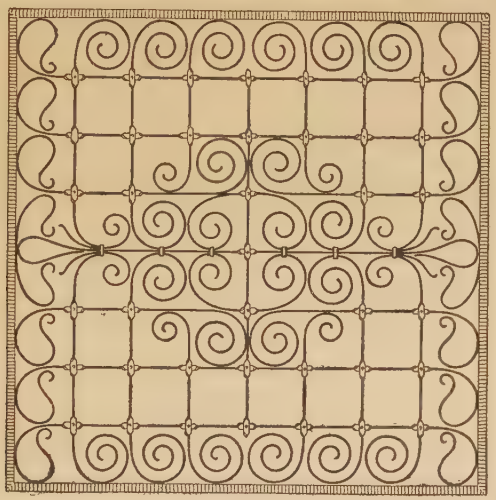


FIG. 14

ment introduced at top and bottom, as shown in Fig. 13 (*a*), or with a border and center ornament, as in Fig. 14. It will

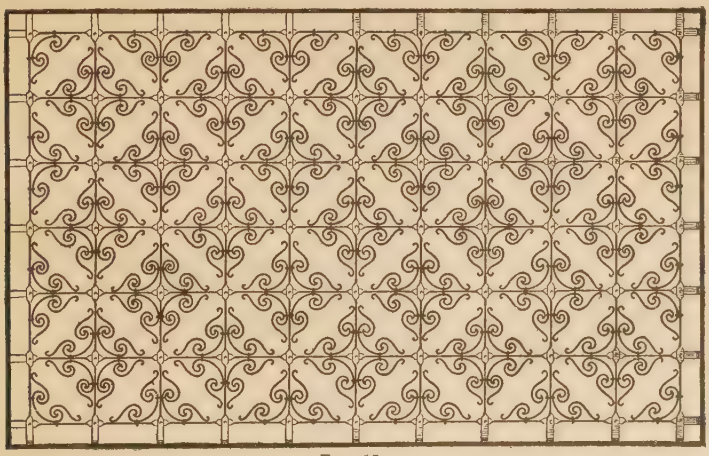


FIG. 15

be seen that the ornament is formed to a great extent by turning the ends of the bars forming the square meshwork into

scrolls, and adding other scrolls as may be desired. This can readily be seen by examining the designs shown, but to make it perfectly clear, some of the component parts of Fig. 13 (*a*)

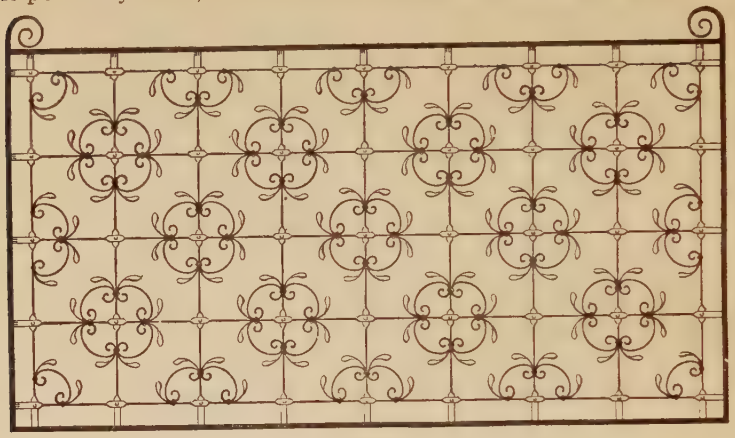


Fig. 16

Fig. 17

are shown separately. The small scroll *a* is shown separately at (*b*); the large central scroll *b* is shown at (*c*); the central division and loop *c* is shown at (*d*); and the small

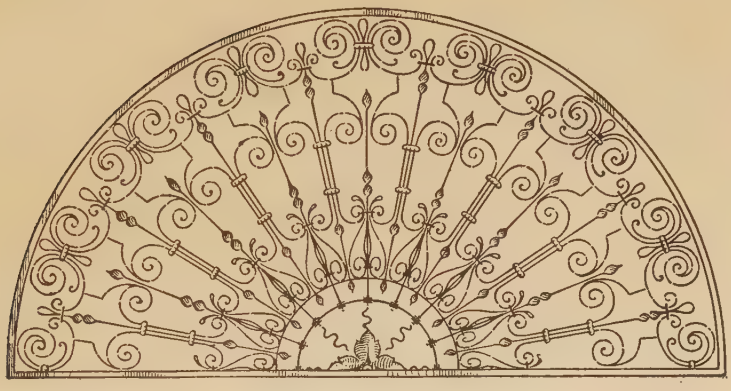


FIG. 18

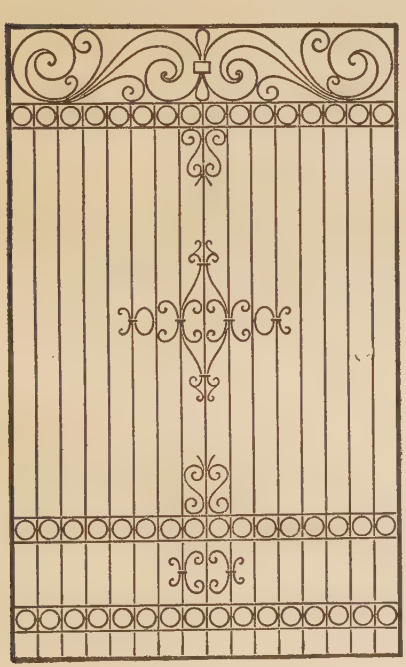


FIG. 19

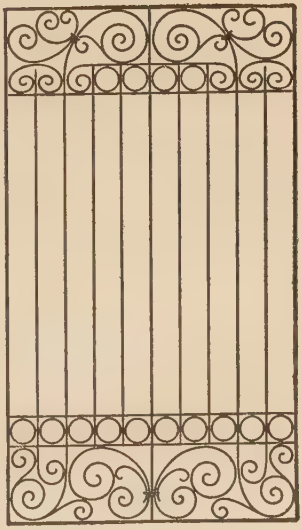


FIG. 20

scroll and ribbon *d* is shown at (*e*). These are all made of single pieces of iron.

The pattern shown in Fig. 15 is designed to produce a diaper effect, as is also Fig. 16, the latter being a more open pattern. All of these designs are for grilles made of light strips not over $\frac{1}{16}$ inch thick by $\frac{5}{16}$ inch wide, though at times heavier material may be employed. Figs. 17 and 18 are radiating designs suitable for arched window or door openings, but in other respects are precisely the same as the grilles just described.

In Figs. 19 and 20, the square mesh is abandoned, and the metal used is somewhat heavier, so that the long straight bars may be strong enough to resist the tendency to bend. There is no set rule for determining the size of iron of which a design should be composed, as this is governed principally by considerations of artistic fitness. If the iron is too thick to be readily twisted at the intersection, it may

FIG. 21

FIG. 22

be half checked, as shown in Fig. 21; or, if one piece is wider than the other, the wide piece may be punched out to permit the narrower one to pass through it, as shown in Fig. 22.

8. Office Grilles.—The metal counter rails in banking houses, offices, etc., so far as the grille-work is concerned, are in no way different from the grilles heretofore described; but the arrangement of the supports, and the height and division of the rail, must all be proportioned to suit the special conditions of each case. Figs. 23 and 24 are examples of grilles made of cast and wrought iron. In Fig. 23, the rail and the posts are of cast iron, but the frame of the grille and the wicket gate and frame are of wrought iron. The grille

is a simple basket pattern of ribbon iron twisted at the intersections and wrought into scrolls at the outside to form a border. The main scrolls of the wicket are finished with cast-iron rosettes. The rail has a cresting produced by extending the post with a finial ornament, and placing a scroll each side of it.

The design shown in Fig. 24 is more elaborate. The posts and rails are of cast iron, as in the former case, as well as the frame surrounding the wicket gate; but the entire screen

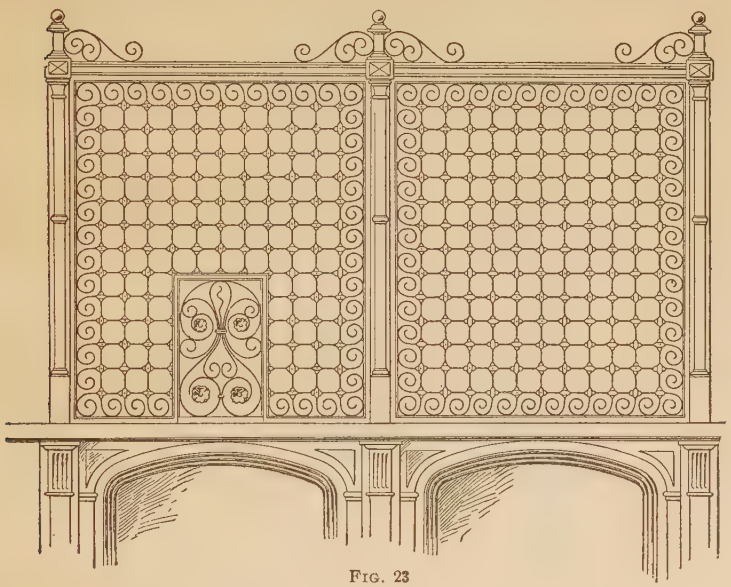


Fig. 23

is backed up with plate glass. The posts have a fluted band above the base, and just above this is a band, or circle, to carry out the line of the baluster rail of the screen. The entire grille of each panel is set in one frame, which is divided into two parts, the lower part forming a balustrade design, and the upper part a diaper; the loop scrolls of the diaper are ornamental with a pendant of leaves, as shown. The frame is separated from the rail, counter, and sides by button washers as shown. The plate-glass panels back of the screen are set in an angle-iron frame fitted with hinges

that swing inwards, so that they may be opened to clean the glass. The wicket frame is designed with architraves and lintel, as would be any door or window. The change shelf under the wicket is made of heavy plate glass on a polished metal plate supported on two console brackets, and is fastened to the plate with countersunk screws through the metal plate. The head of the opening is ornamented with a cast-iron scroll and leaf, but the scroll at the junction of

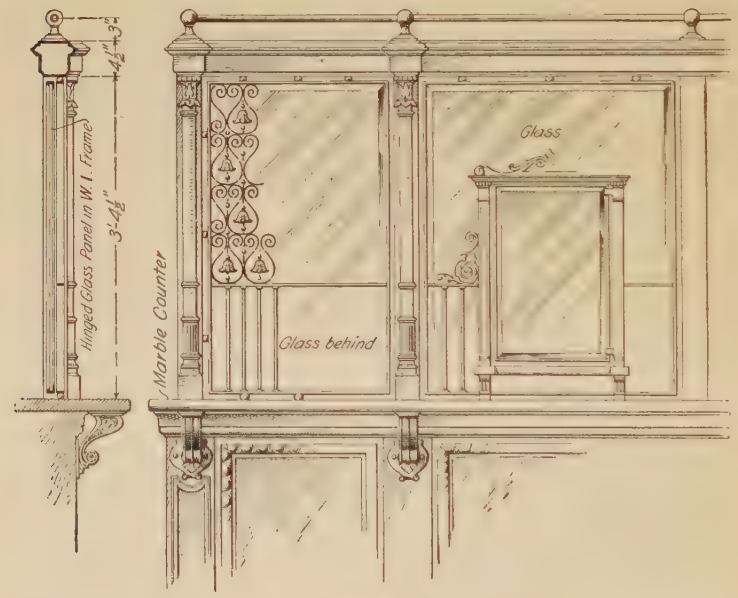
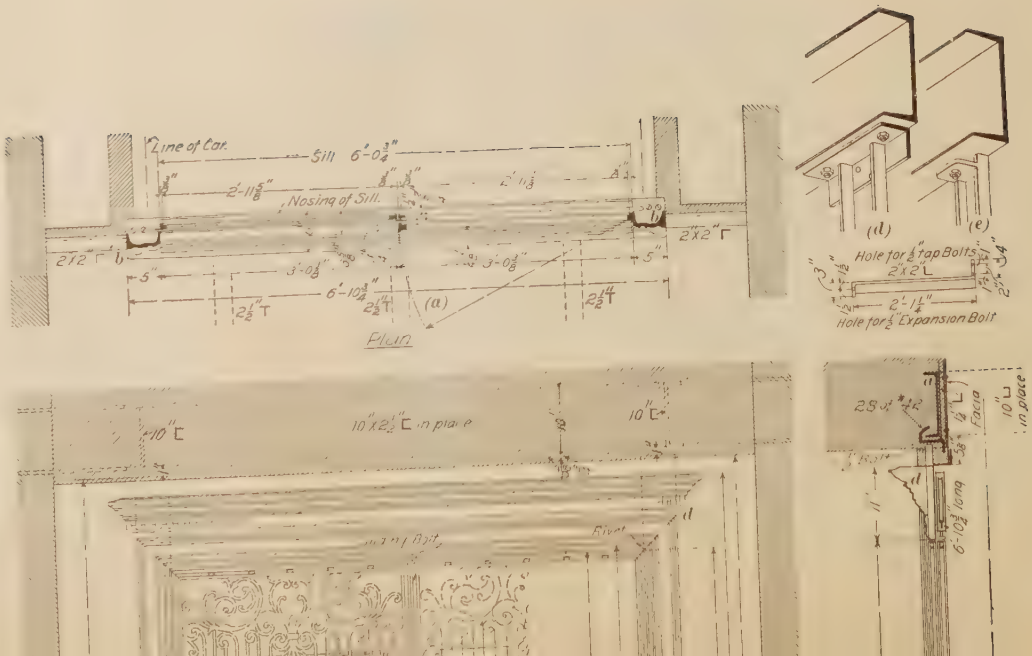
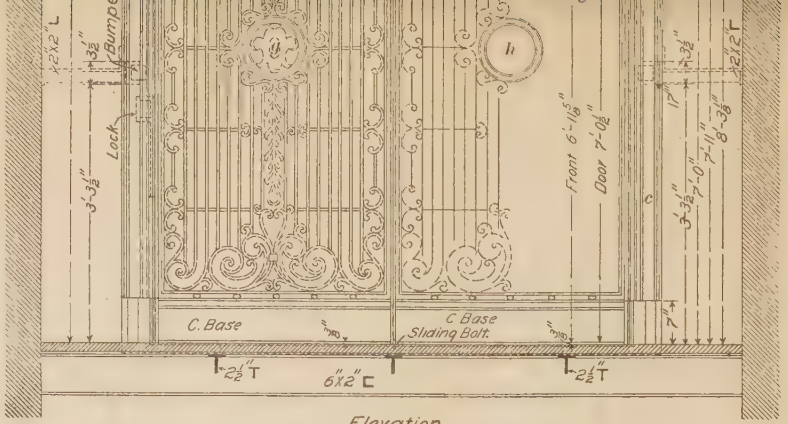


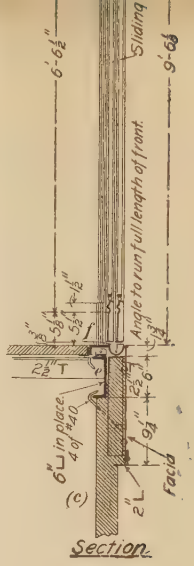
Fig. 24

the frame and the baluster rail is of wrought iron, and is placed there to give rigidity to that point.

The moldings of the rail at the top of the screen are broken around the post to emphasize the divisions of the screen. Over each of these points is a finial ornament, which also serves as a standard through which the brass upper rail passes. These examples represent the usual forms and outline of this class of work, but the details of the design will vary with each individual case.


Line of Car.
Sill 6'-0¾"
Nosing of Sill.
2'-11⅝"
2'-11⅜"
2'12"Γ
2'X2"Γ
5"
3'-0⅛"
6'-10¼"
2½"T
2¼"L
(a)
Plan
(d)
(e)
Hole for ½" tap Bolts
2'X2"L
2'-1¼"
Hole for ½" Expansion Bolt
10"T
10"X2½"C in place
Rivet
2'9"x½"
6'-10¾" long
Facia
10"L in place





177-I L T 33C, 273, 308, 332 § 48

FIG. 25

ELEVATOR ENCLOSURES

9. All the preceding examples of grille-work are suitable for use in elevator enclosures or any similar screen work, and their application to such work will now be considered. In Fig. 25 is shown an example of grille-work front for an elevator shaft. The shaft is formed by the main well of the building in the rear, and fireproof partitions on the sides, the front only being of grille-work. An angle iron or a channel is usually set across the front of the well at each floor, as shown at *a*, Fig. 25 (*c*), the top of which is generally 4 inches below the level of the finished floor of the story above, although the location of these beams, being a matter that is determined in connection with the general structural framework of the building, varies materially in different structures. The enclosure work should, of course, be made to suit the positions of these beams on which it is supported, and the important point is their relation to the finished floor level. In fact, the principal measurements necessary to lay out the work are the width between the partitions, the distance from the finished floor to the top of the beams, the depth of the beams, and the height from floor to floor (which will generally be the same as from beam to beam). Having these points determined, the position of the cast-iron jambs *b*, Fig. 25 (*a*), should be fixed. In this example, the whole opening is surrounded with a cast-iron architrave *c*, shown in the elevation (*b*), consisting of the jambs shown at *b* in the plan, over which is set the cornice *d*, standing independent and distinct from the partition. The jambs rest on top of the steel channel *e*, Fig. 25 (*c*), and are bolted to it at the bottom; while the top is run up and bolted to the bottom of the channel *a*, as the partition itself affords no support. The upper portion of the jamb is checked back from the point where the architrave is mitered, to the bottom of the beam above, in order to permit the cornice to pass in front of it, and to permit it to be enclosed in the partition. The top connections may be made by riveting to the head of the jamb a short piece of angle iron, to project each side of

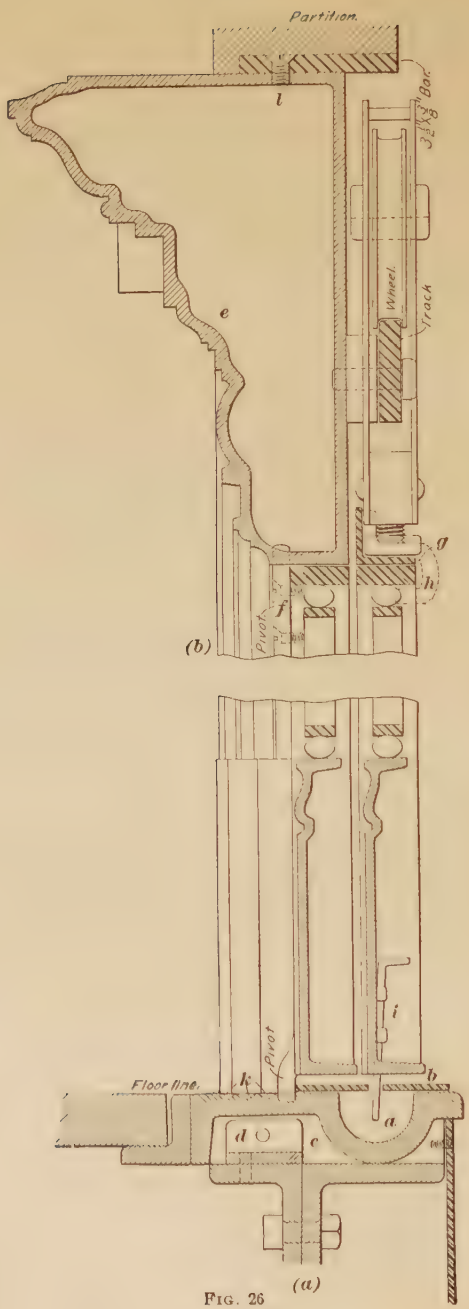

Partition.
l
3½ × 3 Bar.
Wheel
Track
e
g
h
f
Pivot
(b)
i
Pivot
k
Floor line.
b
a
d
c
(a)

FIG. 26

the jamb, as shown at (*d*); or, the top of the jamb may be cast with a flange, or lug, about $\frac{1}{2}$ inch down from the top, as shown at (*e*). The $\frac{1}{2}$-inch clearance permits the jamb to be shortened a trifle if necessary, when fitted to its position.

The jambs being set perfectly plumb, the sill *f* is then put down, and, as will be seen in the section (*c*), the edge next to the floor is turned down about $1\frac{1}{2}$ inches, to form a flat surface for the flooring to finish against. The angular grooves shown at *k* in the large detail of the sill, Fig. 26(*a*), give a better foothold than if the surface were smooth; the deep groove *a* in the same detail is for the bottom guide of the sliding door to travel in, and is made ample in width, and closed in on each side with a strip of wrought iron *b*, to permit of adjustment in case the cast sill is not set exactly true. The wrought-iron plates are also advantageous, inasmuch as they serve better to keep the door in its proper place and reduce the friction surface to the narrow edges of the strips only. As the side of the sill next to the shaft is not deep enough to reach to the beam, upright ribs *c* are cast about 3 feet apart along the under side; and on one side of each of these ribs is riveted a piece of angle iron *d*, which is bolted to the beam. The cornice is a hollow casting, as shown in Fig. 26 (*b*). It is open at the ends where the extensions of the side jambs pass behind it, and it is mitered with the architrave at the corners where it joins and is bolted to the jambs and architrave with countersunk screw bolts. The cornice is fastened to a bar with screw bolts, as shown at *l*, and the bar in turn is bolted at each end to the jambs.

10. In Fig. 27 is shown a plan and horizontal section of the front of the enclosure. The strap brackets *a* are of $2'' \times 2''$ angle iron, and are so placed as to brace the opening laterally. They are bolted to the structural column with expansion bolts, and to the architrave with countersunk screw bolts. The webs *b* of the architrave are thick enough to provide a firm and sufficient hold for the tap or screw bolts securing the door stop. These stops are fitted with a rubber cushion *c*, which takes up the recoil and noise of the door when operated.

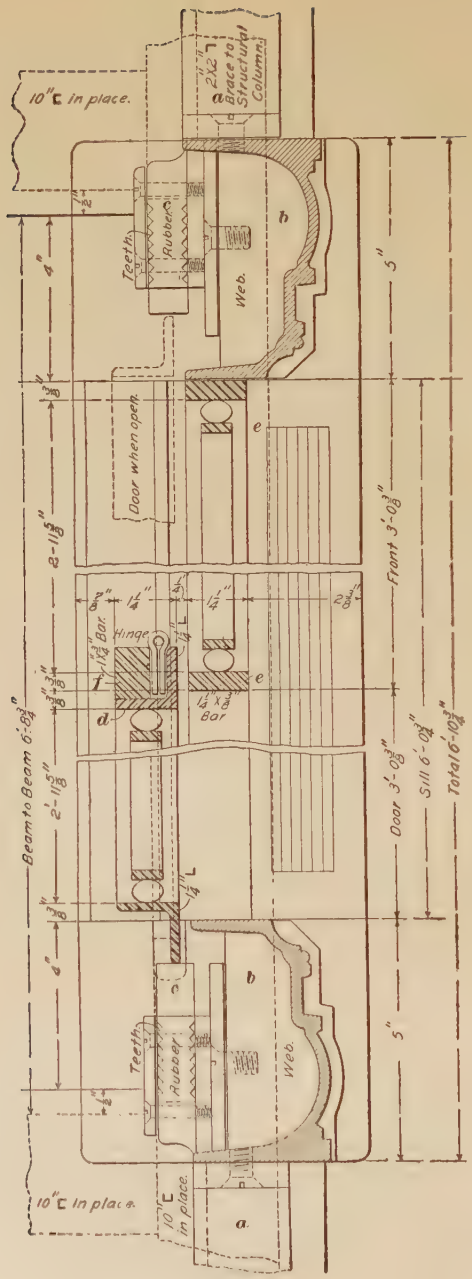

10"C in place.
2x2
Brace to Structural Column
Rubber
Teeth
Web.
b
5"
4"
Door when open
e
2-11⅝"
Front 3'-0⅜"
Door 3'-0⅜"
Sill 6'-0⅜"
Total 6'-0⅜"
Beam to Beam 6'-0⅜"
2'-11⅝"
1¼"
Hinge
1¼ x ⅜ Bar
L
d
4 x ⅜ Bar
a
10"C in place.

FIG. 27

By referring to the elevation, Fig. 25 (*b*), it will be observed that the grille-work is divided into two large panels, one being the door *g*, and the other a pivoted panel *h*. The frame of the door is composed of angle irons, as shown at *d*, Fig. 27, and the frame of the pivoted panel, of flat bars, as shown at *e*. The pivots are fastened to these bars with screw bolts, as shown at *f* in Fig. 26 (*b*). On the sliding door is a bar shown at *f*, Fig. 27, to which the door is hinged. This bar carries at the bottom a guide, which fits in the groove of the track, and is secured at the top to the angle iron *g*, Fig. 26 (*b*), which is a slight extension of the door frame. The door is held in place by the guide bolt *i*, Fig. 26 (*a*), and the panel, by sliding bolts. The reason for this arrangement is to facilitate and make possible the entrance to the elevator of large pieces of furniture; in such a case, the whole front may be swung open by first drawing the sliding bolts in the pivoted panel, then drawing the guide bolts and pushing back the sliding door to its full extent. Both sections are then swung open, the bar and the angle iron remaining attached to the hinges. When used under ordinary conditions, the sliding door is held in place and firmly attached to the hanger by the clips shown dotted at *h*, Fig. 26 (*b*).

11. The hanger consists primarily of a pair of wheels running on a track, from which the door is suspended. These wheels are alike and are set about 12 inches from each end of the door, the position varying somewhat in different doors. Fig. 28 shows the principal features of this hanger, which is patented. The track *a* shown in the section (*b*), on which the wheels run, is fixed to the back of the cornice at each end by cast-iron supporters *b*, Fig. 29, which should be set perfectly level. The track, with the wheels on it, is then put in position, and the bolts *b'* are loosely screwed through the slotted holes in the end. If it is found necessary to further adjust the track, the screws *c* are for that purpose, so that it can be easily set level; then the bolts *b'* are to be screwed up tight. On the arrangement

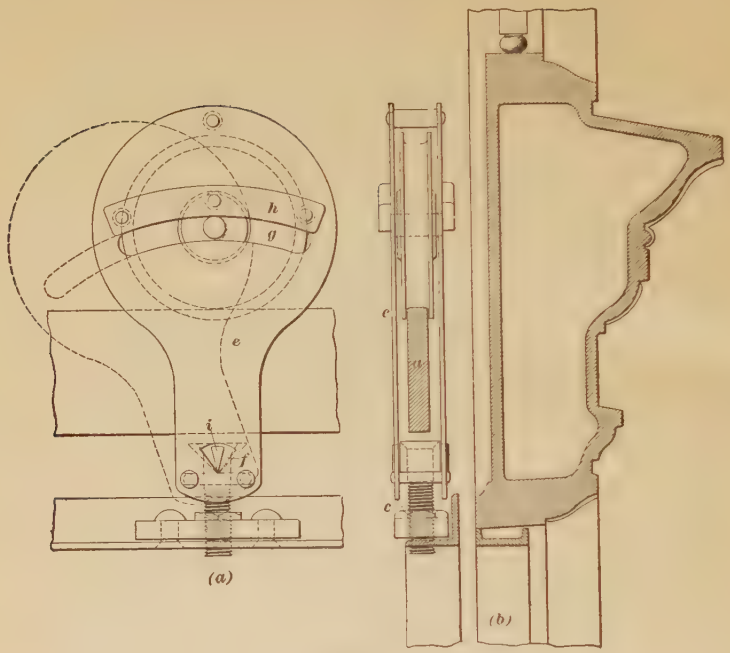


FIG. 28

Note:
After Leveling Track with Adjusting Screw b' tighten Bolt to its limit.

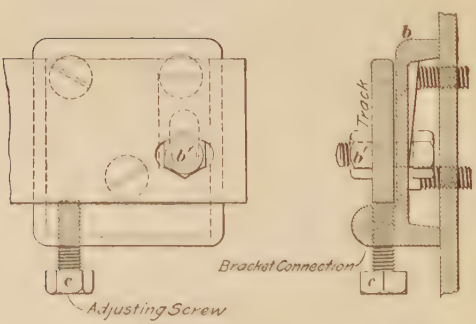


FIG. 29

of the sides that enclose the wheels depends the easy gliding motion. These sides *e*, Fig. 28, are punched out of solid steel. At the lower end, there is a **V**-shaped hole *f* and across the center is a slot *g* reinforced by a steel strap *h* in which the axle of the wheel travels and revolves, as shown in Fig. 28 (*a*). The slot is an arc of a circle whose center is the lower angle of the **V**-shaped hole, and the door is suspended from the knife-edge bearings *i* resting in this **V**. When the door is at rest, the wheel is in the position shown by the full lines, and as it is pushed along, the sheaves gradually swing over to the position shown by the dotted lines, the center of the wheel always remaining over the point of suspension. This prevents any rubbing motion at any point, as the axle of the wheel is not bound in any way, but simply rolls in the slot, and it is evident that the friction at the point from which the door hangs is practically nothing. If it is found necessary to raise or lower the door itself, this may be done, after everything is in position, by turning the suspending bolts *c*, which are squared at the neck to afford a hold for a key or wrench.

12. The construction of the enclosure, as well as the design shown in Fig. 30, differs considerably from that of the preceding example. With the exception of three details, it is entirely of wrought iron, these exceptions being the sill, the transom, and the molding at the top of the lower panels. By referring to the plan (*a*) and elevation (*b*) of the small scale detail, Fig. 31, also the section (*d*), the surroundings governing the design may readily be seen. The main support of the screen is a round bar or column, shown at *a*, Fig. 30, which consists of a $2\frac{1}{2}$-inch wrought-iron pipe fitted with a cap and base. The top is secured to the soffit of the brick arch over the partition with an expansion bolt, and also to the cast-iron sill at the floor level. The grille screen is separated from this column by a small post *b*, which forms the sides of the grille frame and is finished with base and finial. It is fastened to the main column *b* by collar straps *c* on the lower part, and by the transom extension *d*

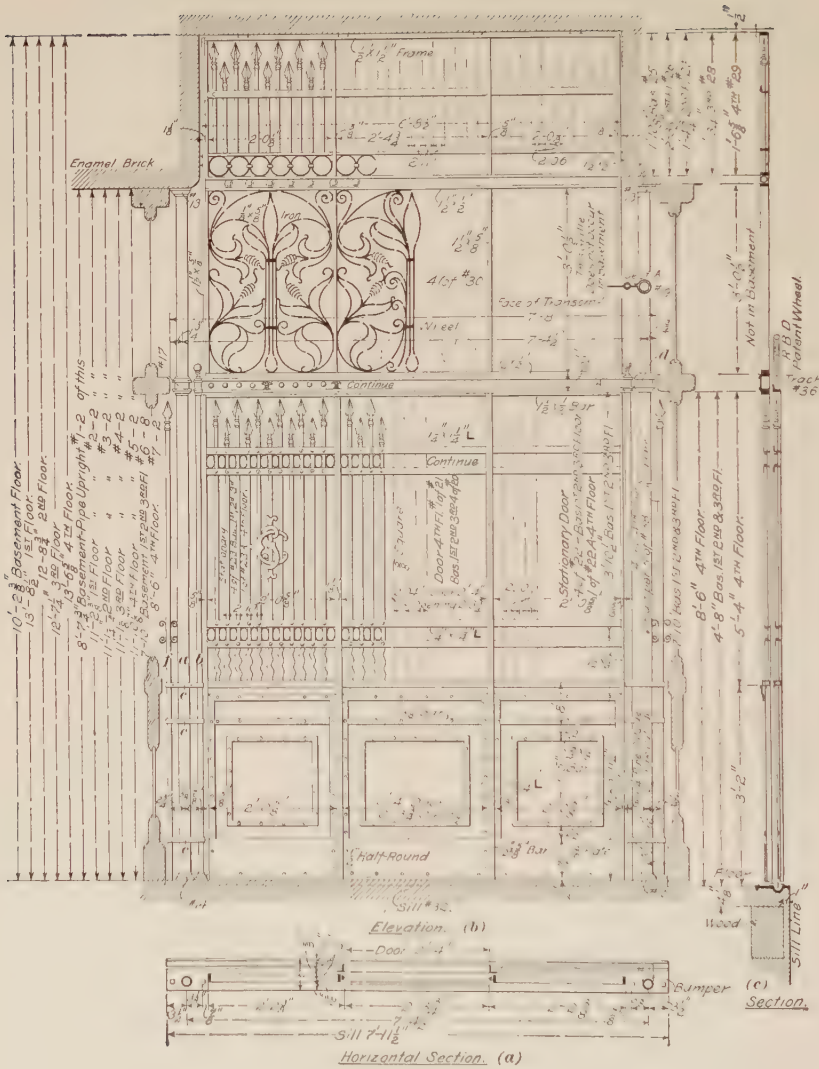

Enamel Brick
Frame
Iron
Wheel
Face of Transom
Continue
Half-Round
Sill #32
Elevation. (b)
Door
Sill 7-1½"
Horizontal Section. (a)
Bumper
Section. (c)
Wood
Floor
Sill Line
Not in Basement
Tracks 7-5/8" #36 Long
Stationary Door
Door-4th Fl. (1 of 2)
Bas. 1st 2nd 3rd & 4th Fl.
10'-2" Basement Floor
13'-8½" 1st Floor
12'-3" 2nd Floor
12'-3" 3rd Floor
8'-7" Basement-Pipe Upright #1-2 of this
11'-3" 1st Floor " " #3-2
11'-3" 2nd Floor " " #4-2
11'-3" 3rd Floor " " #5-2
Basement 1st 2nd 3rd 4th Floor
8'-6" 4th Floor
8'-6" 4th Floor
4'-8" Bas. 1st 2nd & 3rd Fl.
5'-1-4" 4th Floor

FIG. 30

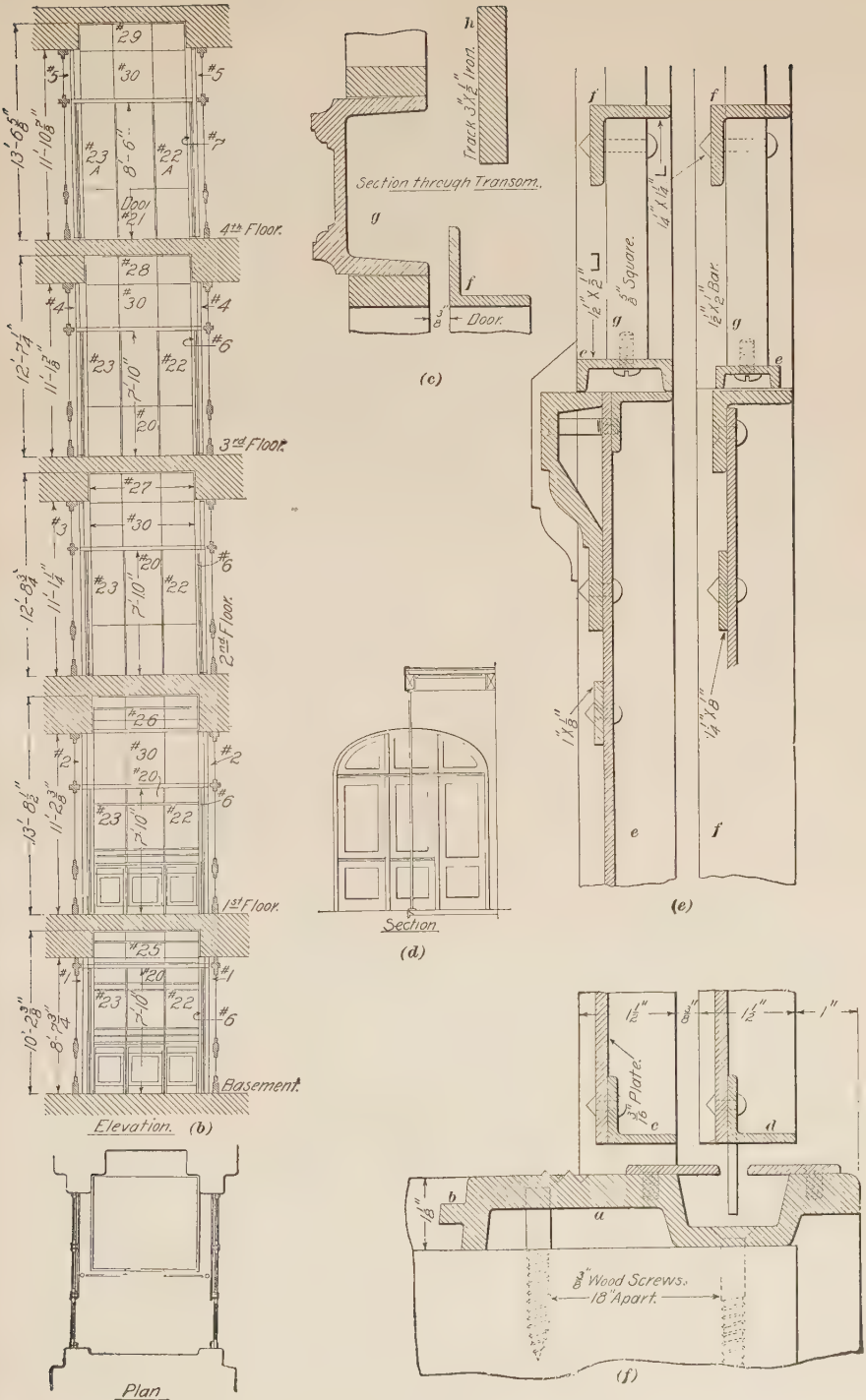

#29
#30
#5
#1
#23 A
#22 A
8'-6"
Door #21
4th Floor.
#28
#4
#6
#23
#22
7'-0"
#20
3rd Floor.
#27
#3
2nd Floor.
#26
#2
1st Floor.
#25
Basement.
Elevation. (b)
Plan
(a)
Section through Transom.
Track 3"x1½" Iron.
h
g
f
a
Door.
(c)
1½"x1" Angle.
⅜" Square.
1¼"x⅛"
1¼" Bar.
1¼"x⅛"
e
(e)
Section.
(d)
1½"
⅜"
1"
Plate.
c
d
b
a
⅜" Wood Screws, 18" Apart.
(f)

FIG. 31

at the top. The jambs of the door opening are formed of half rounds, to correspond to the post *b* and to strengthen the center of the screen. The space between the post and the partition is fitted with a small bar *f* to fill the space between the column *a* and the side walls. The sill shown in detail in Fig. 31 (*f*) has a tongue *b* cast on it to receive the finished floor, which is grooved to fit over this tongue and thereby make a snug and unyielding joint. The stationary panels of the screen each side of the door have a dado panel in plate iron, and grille-work above; the same treatment being used in the door.

13. A section of the screen, Fig. 30 (*c*), shows the sliding door on the inside of the shaft and the hanger above. Fig. 31 (*f*) shows a section through the cast-iron sill and the method of screwing it to the wooden under floor. At *d* is a section of the bottom of the sliding door, while at *e* is the fixed panel. The sections of the upper moldings on the dado panel of the door and screen are shown in Fig. 31 (*e*); and at *g* is seen the elevation of the lower part of the bars of the grille, and the screw that secures each of them to the channel iron forming the surrounding and protecting frame. In Fig. 31 (*c*), a section of the transom bar is shown at *g*, a section of the top of the door at *f*, and the track on which it slides at *h*. The enclosure on each story being similar in design, it is not necessary to detail each one. A general plan and elevation is given in Fig. 31 (*a*) and (*b*), and one detail plan and elevation in Fig. 30, on which the varying dimensions of all the stories are marked. Each piece is numbered, and the quantity is also noted on these drawings. In all cases, the drawings are accompanied by a list or schedule.

14. The general construction of all elevator enclosures is practically the same as the examples given in the preceding articles and further details are unnecessary. In the enclosure screen shown in Fig. 32, the architrave is of cast iron, the general outlines and form of which are designed to correspond with the adjoining trim. This architrave is

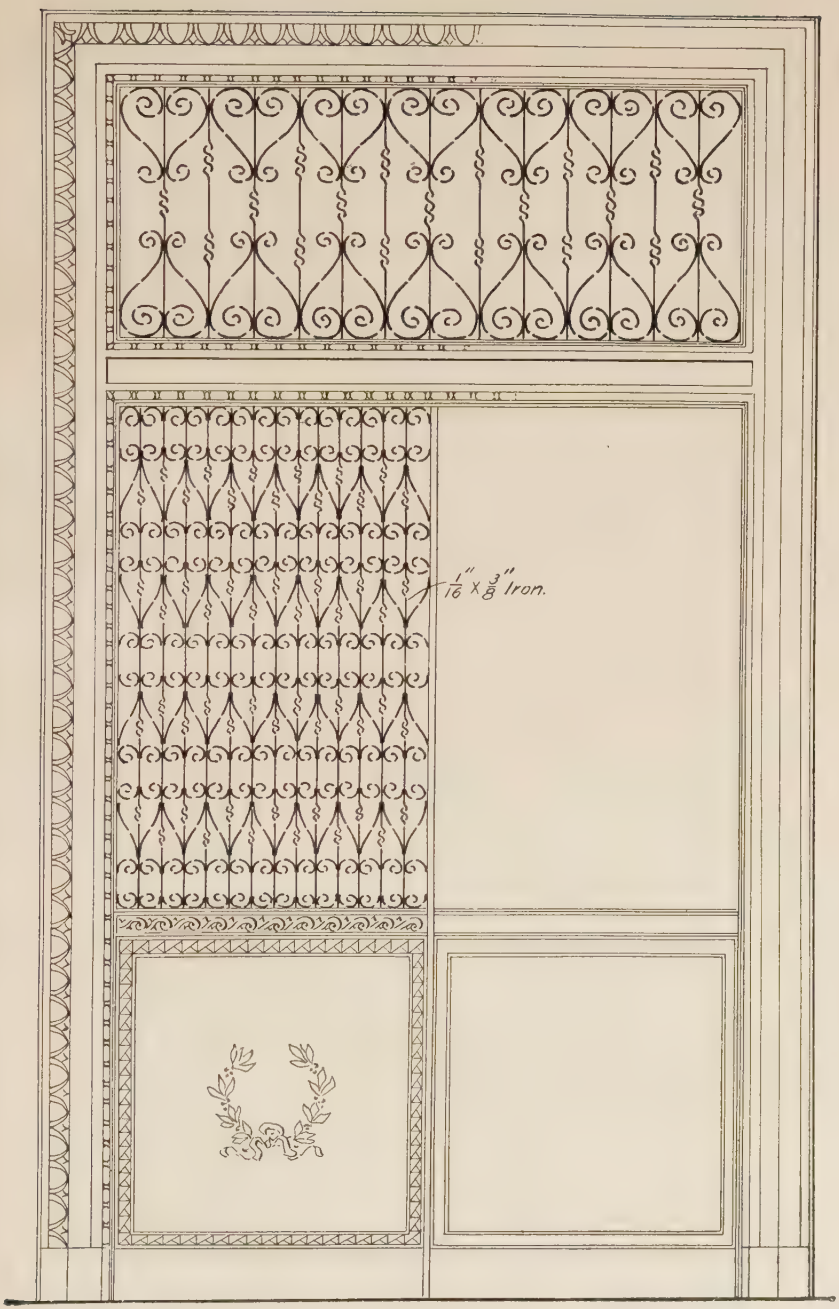


FIG. 32

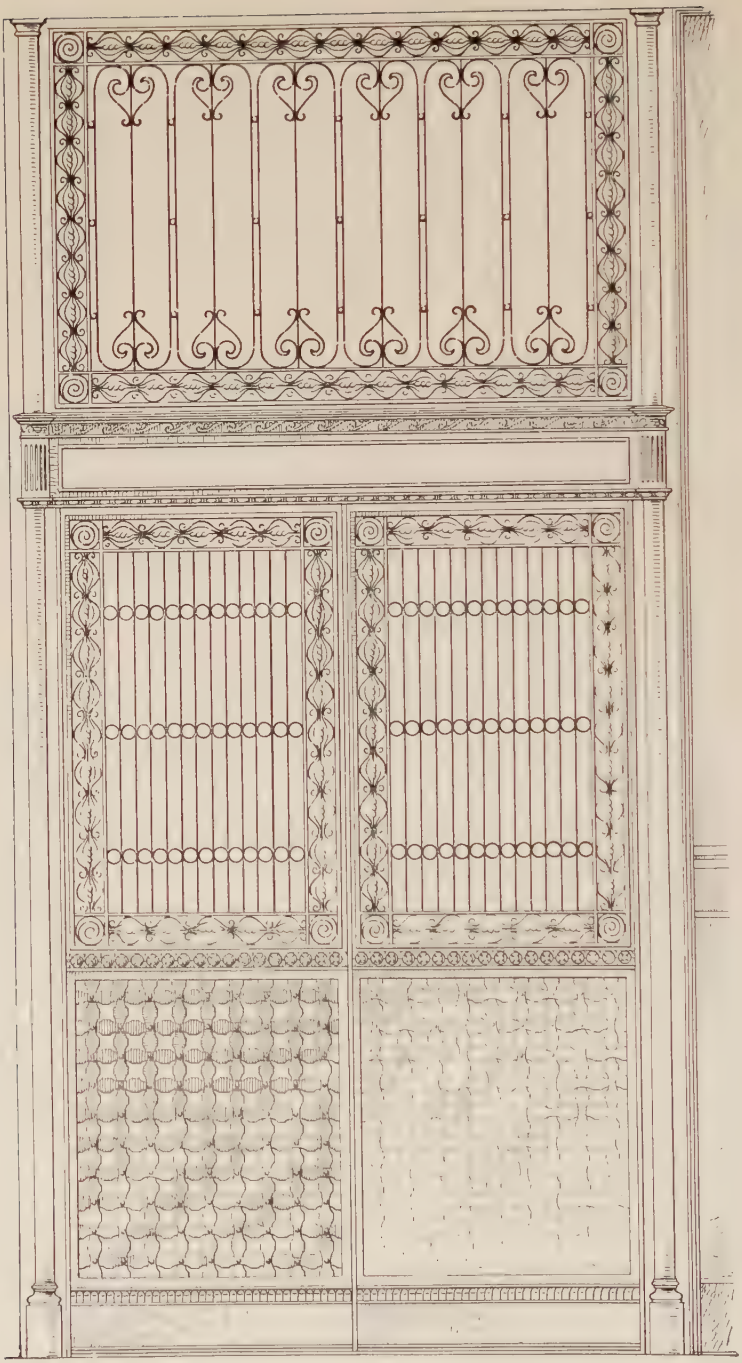


Fig. 23

decorated on the jamb side with a spool-and-spindle fillet mold, and on the outer edge with an egg-and-dart echinus molding. The dado panel is of sheet iron surrounded with a tooth molding, and the center is decorated with a wreath of myrtle leaves, berries, and ribbon in wrought or cast iron. The grille of the door is much closer than the transom grille, thus giving a heavier and close effect in the proper place. Both these grilles are formed from $\frac{1}{16}'' \times \frac{3}{8}''$ strap iron set with the edge to the front, the very open portions being relieved by twisting the bars so as to produce a spiral, showing the full width of the bar to the front.

15. In Fig. 33, the whole screen is formed of wrought iron, except the transom bar. This design presents several very agreeable and pleasing features; it is well balanced, and the transition, which should always be studied in design, from the heavy effect in the dado to the light area in the transom, is here well defined. The dado is especially good, as it combines protection, good design, and cheapness. The pattern, which is a diaper, is made of the usual basket strap work with the edges cut to the form shown. The rail is not too heavy, and shows a molding with a rosette-and-leaf decoration. The filling of the panel is of a series of bars well braced and bound together with three rows of rings. The transom bar—the only piece of cast iron—is finished at the ends with fluted and molded collar bands, through which the columns supporting the screen pass. The transom grille border is a repetition of the door grille, and the center is composed of six very open panels, separated by small button washers, thus completing the screen.

16. Fig. 34 is given as a fine example of wrought iron and cast iron combined. The large pilasters break the long stretch of grille-work into bays, at the same time serving to cover and decorate the plain structural-steel columns that are hidden behind them.

17. Ornamental iron elevator enclosures are sometimes combined with other materials, such as marble. Fig. 35 is a good specimen of this treatment. The white squares seen

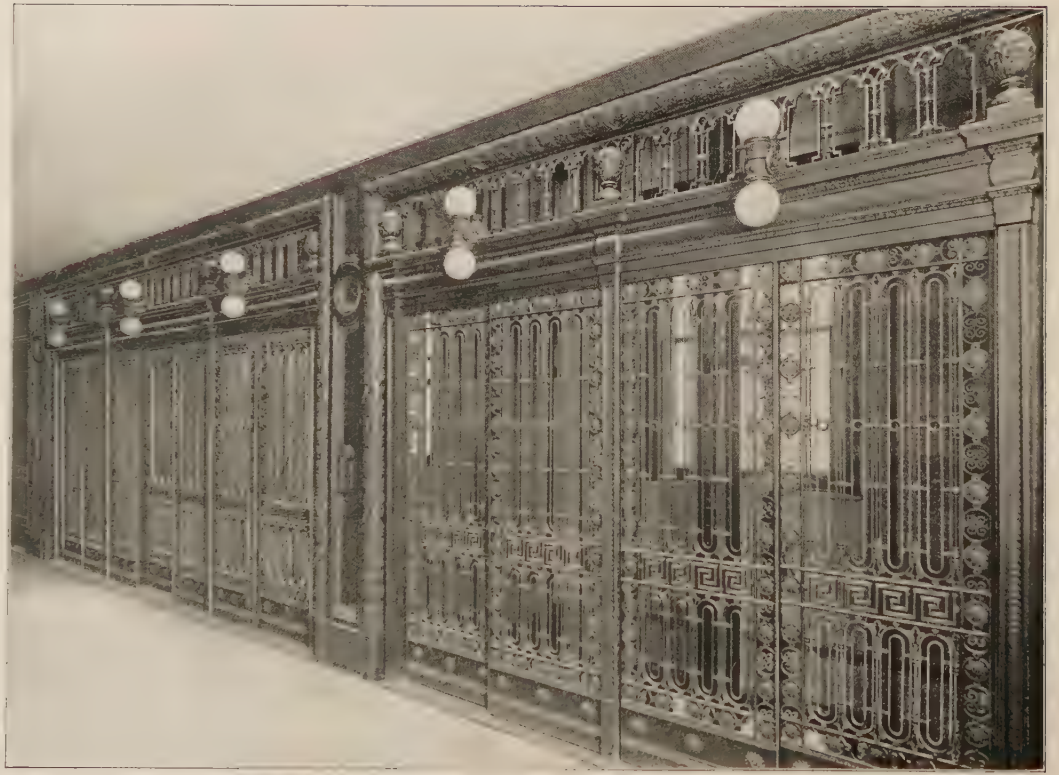


FIG. 34

Fig. 35

over the doors are merely notice boards placed there for the direction of the public. When it is known in advance that

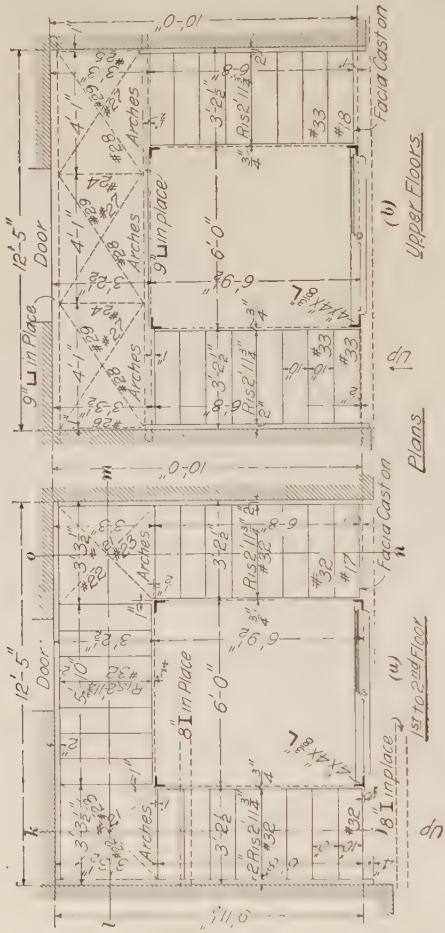


Fig. 36

such notices are likely to be needed, it is better to form a suitable place for them in designing the transom grille.

COMBINED ELEVATOR AND STAIR SHAFTS

18. In fireproof buildings, it is a common practice to combine the elevators and stairs in one shaft. In such cases, the elevator usually occupies the center of the shaft, and the stairway is constructed around it. Such a combination is shown in plan in Fig. 36, where the arrangement of stairs and elevator shaft on the first floor is shown at (*a*), and on the upper floors at (*b*). A $6' \times 6' 9\frac{1}{2}''$ elevator shaft is thus provided, around three sides of which rises a stairway 3 feet $2\frac{1}{2}$ inches in the clear. So far as the details of the stairs are concerned, they are precisely the same in principle as those described in *Ornamental Metal Work*, Part 1; the wall strings are first set in place, then the face strings (which in this case are the well strings), and finally the risers and treads. The well strings, however, have to be considered with the elevator shaft, as they form a part of that structure; and the details of the grille-work screen around the elevator shaft should include a treatment that will take the place of a balustrade on that side of the stairs.

The elevations of the wall strings, the outside strings, and the sides and back of the enclosure, also the front elevation of the enclosure, are shown in Fig. 37 (*a*), (*b*), (*c*), and (*d*). The grille-work on the first story is of brass, and on the stories above, of iron.

19. As in the previous examples of stair work, the first procedure is to fix the number of risers and the width of the stairs. The height, as shown in Fig. 37 (*a*), is 14 feet $8\frac{1}{4}$ inches between the first and second stories; and to determine the number of risers, the size of the well hole, as well as the approximate space that the elevator will occupy, should be considered, though the latter may be modified to work out the stairs. It will be seen that twenty-six risers each 6.77 inches high, counting from top to top of the treads, gives nine risers each side of the well and eight at the back. This will permit the treads to be 10 inches wide on the sides and back, all finishing nearly symmetrically at

the corners. The face of the first riser leading down the stairway, as shown in Fig. 36 (*a*), is $\frac{1}{2}$ inch from the corner of the angle-iron frame of the well, and the ninth riser is 1 inch from the corner of the corresponding angle at the back

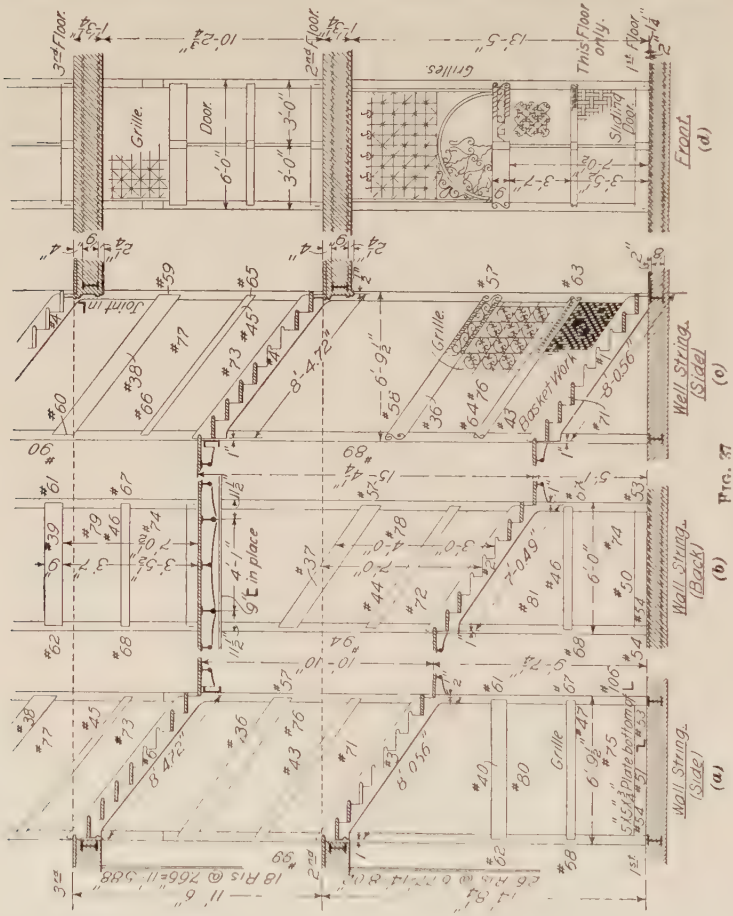


FIG. 37

of the shaft. The upper part of the opposite side is similar, and the run at the back has the tenth and seventeenth risers, each 1 inch back of the angle iron, thus in each case allowing sufficient room for the finished tread to stop inside the edge of the angle. In planning any stair that is broken by

intermediate platforms, the starting riser of each section should, if possible, be kept the same distance from a fixed point; in this example, these points are represented by the angles at the corners of the well. Circumstances may arise, as in the present case, when this arrangement is not possible, and then the space is divided as equally as possible.

The upper stories being less in height than the first story, fewer risers are required; and, by making them 7.66 inches high, the plan of the stair on each side of the well remains the same as the first story, while at the back the platform extends across the full width of the well. In fact, the stairs in every case should be planned as a whole, and not simply flight by flight.

20. The plans being determined, the wall and outside, or well, strings, and the sides and back of the enclosure should be laid out on the section lines *j k*, *l m*, and *n o*, shown in Fig. 36 (*a*), the developments of which are shown in Fig. 37 (*a*), (*b*), (*c*), and (*d*), and in Fig. 38 (*a*), (*b*), and (*c*). The elevation of the front is also shown in Fig. 37 (*d*). In most stairs, the platforms are of slate or marble, and must be supported at the center or diagonally by either cast- or wrought-iron ribs or arches, as indicated by the dotted lines shown on the plans, Fig. 36. The development and details of the parts of the enclosures and stairs are shown in Fig. 39; (*a*) shows the head of the outside string in sectional elevation and plan at the first platform, between the first and second stories; (*b*), the foot of the outside string in sectional elevation and plan at the first platform, between the first and second stories; (*c*), the wall string in sectional elevation and plan at the first platform, between the first and second stories, and an elevation of the arch rib supporting the platform and the springing block to which the rib is bolted. At (*d*) is shown the sectional elevation and plan of the head and foot of the outside string, with the enclosure of basketwork and grille as they exist in the upper stories, and (*e*) shows the sectional elevation and plan of the wall string of the same run. At (*f*) is shown a sectional elevation and plan of the

head and foot of the outside string on all the platforms and landings of the upper stories. At (*g*) is shown the wall string and the platforms and landings of the same run. In

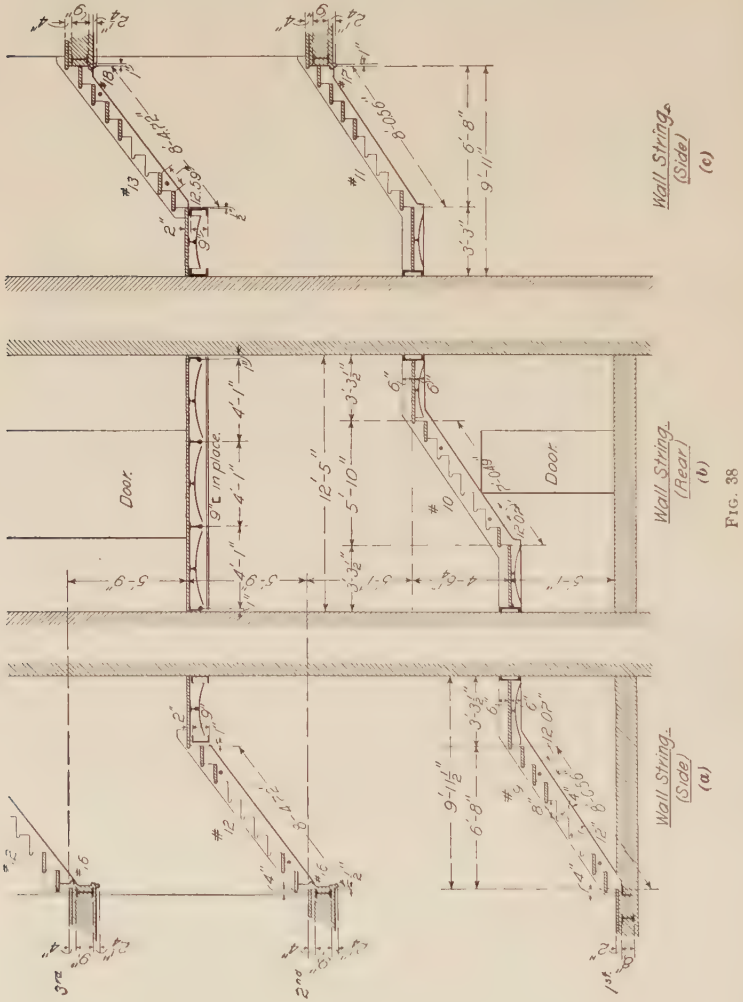
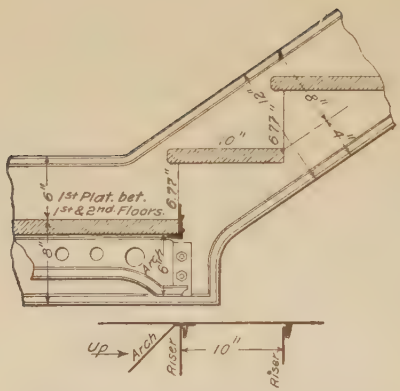
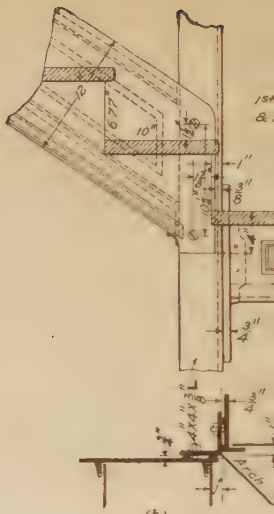


Fig. 38

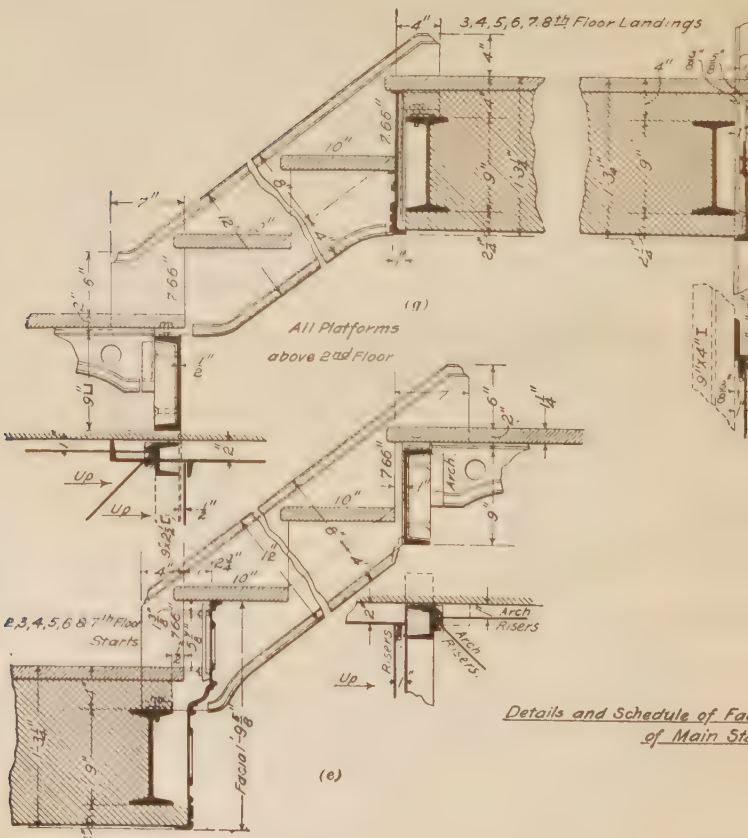
Fig. 40 is shown the elevation and section of the rib arches that support the platforms. The ends are checked out $\frac{3}{4}$ in. $\times$ 1 in., where they rest on the springing blocks, as shown.



(c)



(b)



(g)

(e)

Details and Schedule of Fa
of Main St

(a)
All Platforms bet. 2nd & 8th Floors
All Grill Work to be Bronze-plated. All other Work to be painted, except Transoms, Center Rails and Leaves, which are to be Bronze-plated.
Holes cored in Strings for ⅞" Countersunk Bolts.
2, 3, 4, 5, 6 & 7th Floor Starts.
Hole for ⅞" Bolt
(d)
Up
Strings.

Fig. 40 shows at (*a*) the plan of these platform arches for the first story, and at (*b*) for the upper stories, while the springing blocks that support these ribs are shown at (*c*).

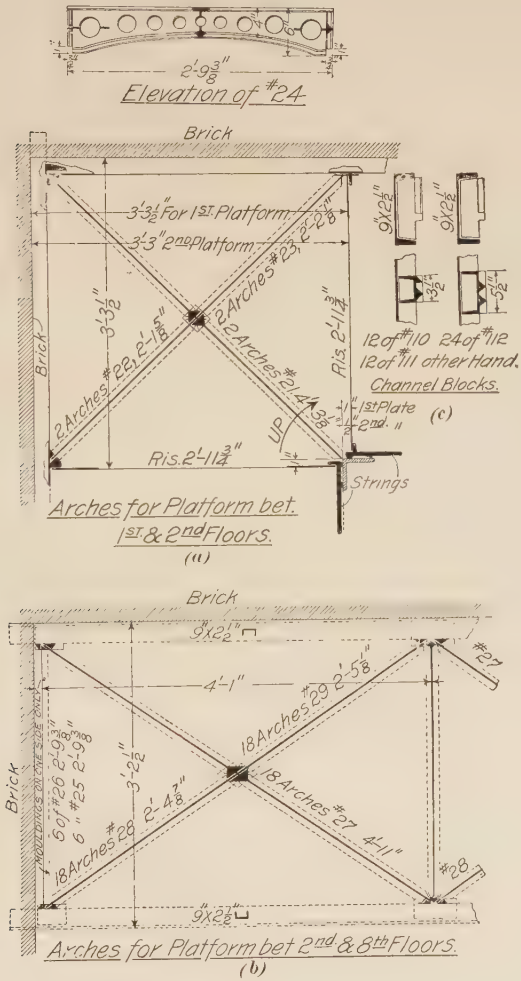


Fig. 40

They are cast channel shape, with the web, or socket, and the lug on the face. The upper drawings at (*c*) show these blocks in elevation, the lower drawings in section.

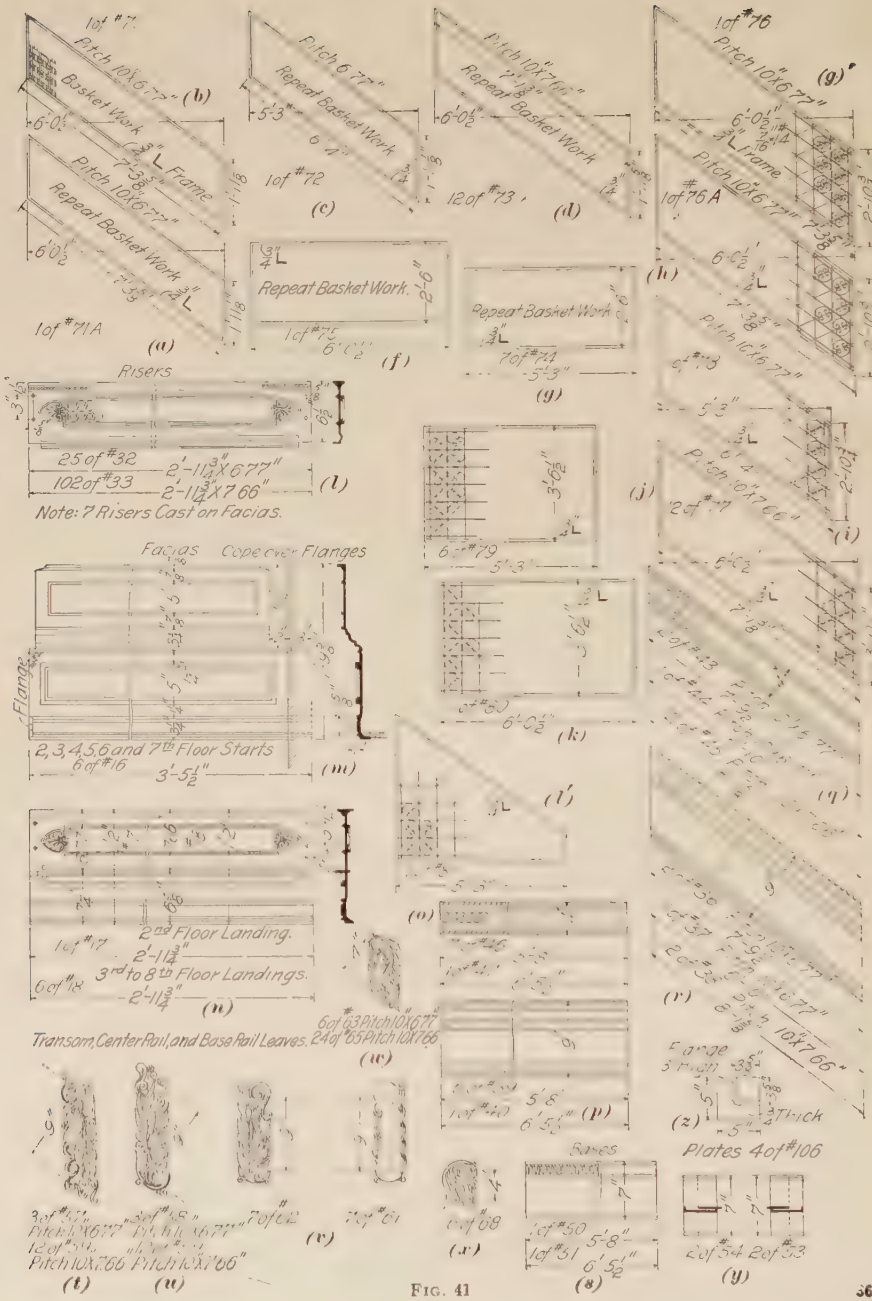

1 of #71
Pitch 10X6 77"
Basket Work
6'-0½"
L Frame
Repeat Basket Work
1 of #71A
(a)
(b)
1 of #72
Repeat Basket Work
(c)
12 of #73
(d)
1 of #76
Pitch 10X6 77"
(g)
1 of #76A
(h)
Repeat Basket Work.
1 of #74
(f)
76 of #41
(g)
Risers
25 of #32
2'-11¾"X677"
102 of #33
2'-11¾"X766"
(l)
Note: 7 Risers Cast on Facias.
Facias
Cope over Flanges
Flange
2, 3, 4, 5, 6 and 7th Floor Starts
6 of #16
3'-5½"
(m)
2nd Floor Landing.
1 of #17
2'-11¾"
3rd to 8th Floor Landings.
6 of #12
2'-11¾"
(n)
Transom, Center Rail, and Base Rail Leaves.
6 of #3 Pitch 10X677"
24 of #5 Pitch 10X766"
(w)
6 of #79
(j)
(k)
(l')
(o)
(p)
(q)
(r)
Flange
Thick
Plates 4 of #106
(z)
3 of #57 Pitch 10X677"
3 of #58 Pitch 10X677"
7 of #62
12 of #64 Pitch 10X766"
Pitch 10X766"
(t)
(u)
(v)
7 of #61
1 of #68
(x)
Bases
1 of #50 5'-8"
1 of #51 6'-5½"
(s)
2 of #54 2 of #53
(y)

FIG. 41

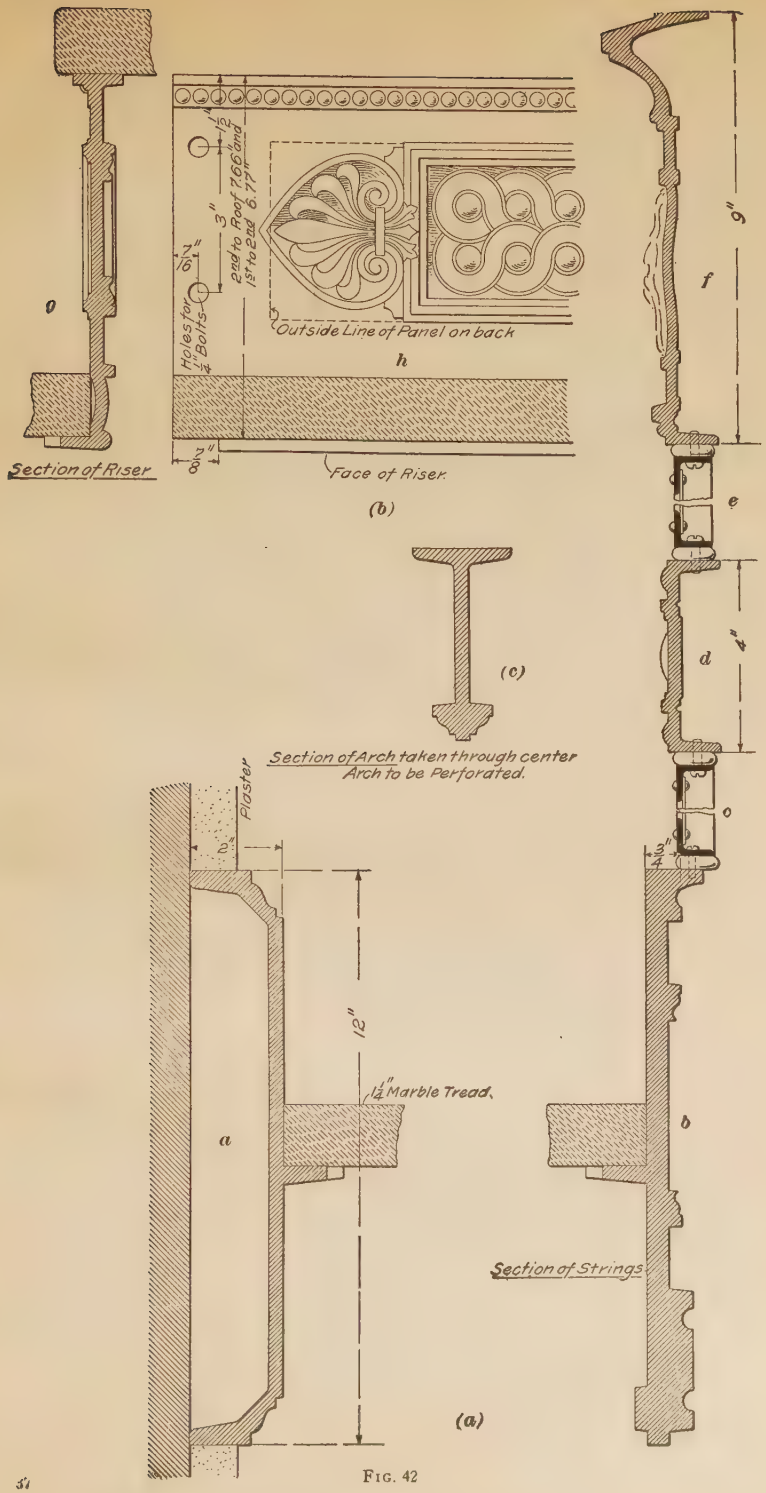

g
Section of Riser
Holes for ½" Bolts
3"
2nd to Roof 7.66 ins
1st to 2nd 6.77"
Outside Line of Panel on back
h
Face of Riser
(b)
f
9"
e
d
4"
c
(c)
Section of Arch taken through center
Arch to be Perforated.
Plaster
2½"
12"
1¼" Marble Tread
a
b
Section of Strings
(a)

FIG. 42

21. The risers shown in Fig. 41 (*l*) are for all starters on each floor, and for all intermediate risers. The fascias or finish at back of risers underneath stairways shown in Fig. 41 (*m*) are at the start of the upper stories, and form a finish from the first tread (going up) to the plaster of the the ceiling below. See Fig. 39 (*d*). The seven risers cast on the fascias are shown at (*n*), and are for the upper landings, and form a finish from the last tread (going up) to the under side of the plaster. A number of the rails and bases are shown at (*o*), (*p*), (*q*), (*r*), and (*s*); the base (*s*) finishes the enclosure on the first floor only. The center rails (*o*) and (*p*) extend throughout all floors, as do the top rails (*q*) and (*r*). The leaves forming the finish, and covering the joints of the transom, center rail, and base rail, are shown at (*t*). See Fig. 39 (*d*). The finish at the base of the angle irons at the first floor is shown at (*y*) and (*z*), the latter being the plate that is bolted to the I beams to form the foundation of the enclosure, the four angles at the corner being bolted to these plates. The basket grille, which forms the dado of the enclosure, is shown at (*a*), (*b*), (*c*), (*d*), (*f*), and (*g*), and the grille-work at (*g'*), (*h*), (*i*), (*j*), (*k*), and (*l'*).

22. Fig. 42 (*a*) shows the strings, enclosure, arch, and riser in detail. The wall string is shown at *a*, and the well string at *b*; the frame of the basket grille composed of small angle irons is shown at *c*, and the center rail at *d*; the grille frame composed of small angles at *e*, and the top rail at *f*. A section of the riser and an elevation of the front of the same are shown at *g* and *h* in Fig. 42 (*b*); and the arch rib is shown in Fig. 42 (*c*).

ELEVATOR CARS

23. **Elevator cars** are usually constructed of angle iron or pipe framework, which is filled in with woven basketwork and twisted-iron grille-work and scrollwork. The design of the grille-work is usually similar to, if not identical with, the design of the grille of the enclosure, though sometimes certain conditions require a stronger and less elaborate design in one place than in the other.

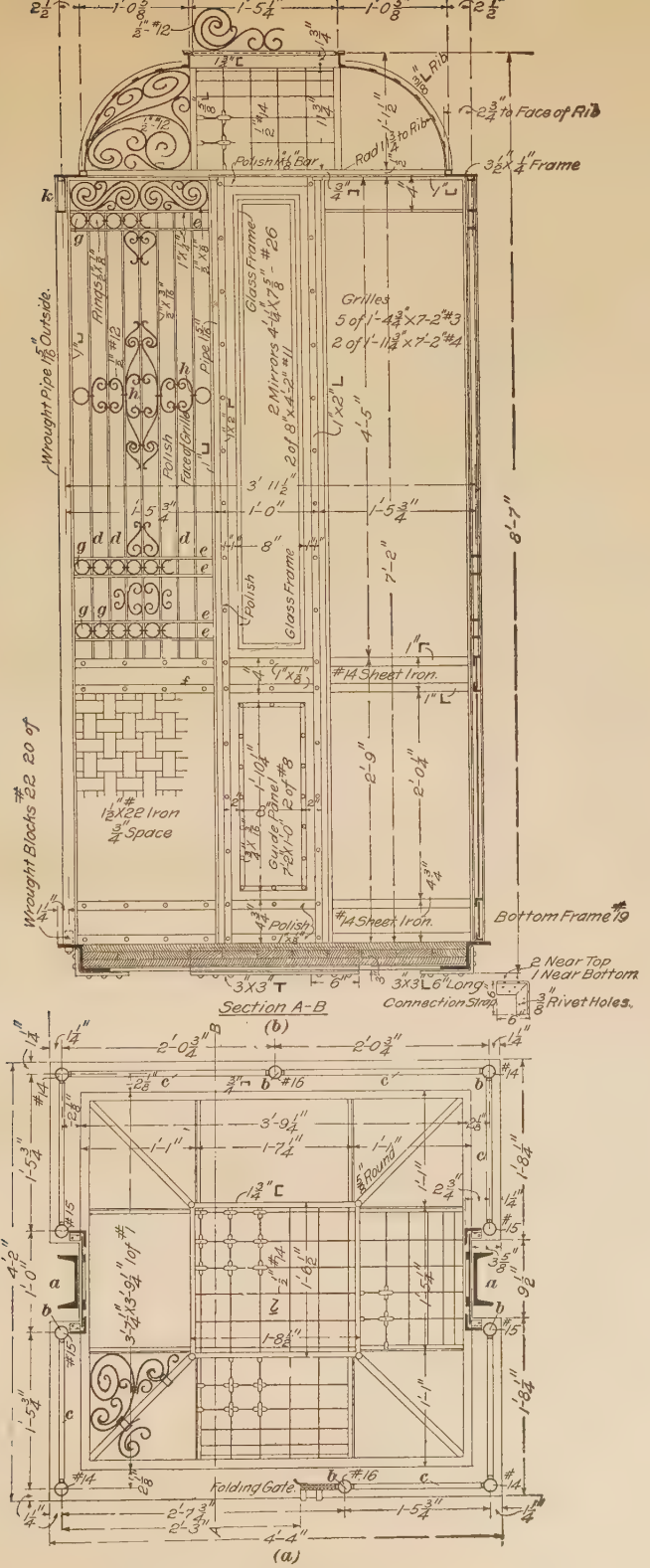

Wrought Pipe 1½" Outside.
Wrought Blocks #22 20 of
1½X22 Iron
¾" Space
Glass Frame
2 Mirrors 4'-4"X7'-5" #26
2 of 8"X4'-2" #11
Grilles
5 of 1'-4¾"X7'-2" #3
2 of 1'-11¾"X7'-2" #4
Polish Face of Grille
Pipe 1½"
Polish
Glass Frame
Guide Panel #8
2 of #22 1'-0"
#14 Sheet Iron.
Bottom Frame #19
Polish Rod 1½" Bar
2¾" to Face of Rib
3½"X¼" Frame
2 Near Top
1 Near Bottom
⅜" Rivet Holes.
3"X3"X6" Long Connection Strap
Section A-B
(b)
Folding Gate.
(a)

FIG. 43

In Fig. 43 is shown a plan (*a*) and a section (taken on the line *A B*) or interior elevation (*b*) of the elevator car, the design of which is simple and inexpensive, while the construction is substantial and serviceable.

The plan (*a*) shows two recesses *a*, *a*, in which are located the guides, thus permitting the car to extend the full width of the shaft. The frame of the car is composed mostly of wrought-iron pipe, as shown at *b* in the plan, between the vertical members of which small channels *c* are secured to receive the basketwork and grilles. On the inside of the car the guides are covered with sheet-iron dado panels, extending 2 feet 9 inches above the floor and with a beveled plate-glass mirror from here to the top of the car. The rest of the side walls of the car, with the exception of the door, is composed entirely of grille-work.

24. The dado consists of a simple basketwork of $1\frac{1}{2}$-inch iron straps, spaced $\frac{3}{4}$ inch apart and secured by riveting the end of each strap to the leg of a 1-inch angle iron, as shown at *f*, Fig. 43 (*b*). The space between the dado and the grille-work consists of a sheet-iron panel secured in place by riveting it to the vertical legs of two 1-inch angle irons, which are framed in between the vertical supports.

The grilles forming the upper part of the elevator are composed of $\frac{1}{2}'' \times \frac{3}{16}''$ bars *d*, which are held vertically in place by means of $1'' \times \frac{1}{4}''$ horizontal rails *e*, through which the vertical members extend. By arranging the rails in pairs and keeping their distance apart equal to the spaces between the vertical members, a series of squares is formed, in which rings are inserted, as shown at *g*, thus bracing the joint and rendering the entire grille stiff and secure. Across the middle of the grille, a series of scroll ornaments *h* relieves the plainness of the panel, while at the same time it gives lateral stiffness to the vertical bars. At the top of the wall panels a scroll design *k* forms a frieze at the ceiling line, and it serves to combine the character of the side walls with that of the domed roof. The grilles of the roof are of simple twisted strap iron, such as described in Art. **5**, and scrollwork.

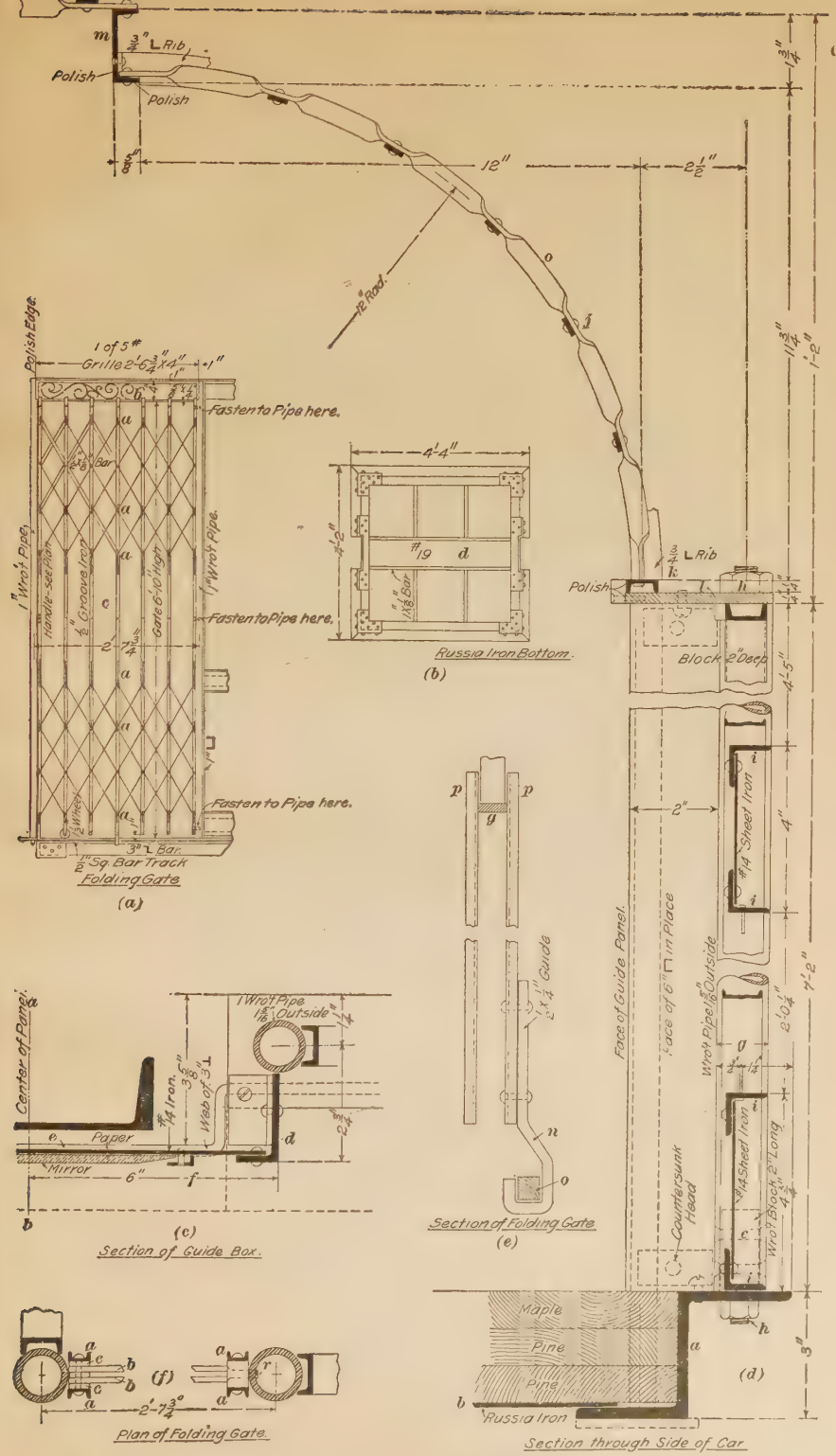

Polish Edge
1 of 5#
Grille 2'-6¾"X4"
Fasten to Pipe here.
Fasten to Pipe here.
Fasten to Pipe here.
1" Wrot Pipe
1" Wrot Pipe
Gate 6'-10" high
2'-7¾"
3" L Bar
½" Sq. Bar Track
Folding Gate
(a)
4'-4"
#19 d
Russia Iron Bottom
(b)
Polish
L Rib
Block 2" Deep
Face of Guide Panel
Face of 6" ⊓ in Place
1" Wrot Pipe Outside
¼ Sheet Iron
2'-0¼"
7'-2"
Countersunk Head
¼ Sheet Iron
Wrot Block 2" Long
Maple
Pine
Pine
Russia Iron
(d)
Section through Side of Car
Guide
Section of Folding Gate
(e)
Center of Panel
1" Wrot Pipe Outside
¼ Iron
Web of 3" L
Paper
Mirror
6"
(c)
Section of Guide Box.
2'-7¾"
(f)
Plan of Folding Gate.
12" Rad.
12"
2½"
1¾"
1'-2"
11¾"
4"
3"

FIG. 44

25. In Fig. 44 (*d*) is shown a section through the side of the car, illustrating on a larger scale the details of its construction. The rectangular floor frame is composed of 3-inch **Z** bars as shown at *a*, and three thicknesses of wood flooring, lined with a Russia-iron shield *b*, resting on the lower flange of the **Z** bar, while the walls of the car are secured to its upper flange. The corner and intermediate supports *g*, composed of $1\frac{5}{8}$-inch wrought-iron pipe, are secured to the upper flange of the **Z** bar *a* at the floor level, and to a $\frac{1}{4}$-inch wrought-iron plate *l* at the top. This is accomplished by plugging the ends of the pipes with wrought-iron blocks and riveting the blocks in place through the pipe, as shown dotted at *c*. The ends of the plugging blocks are then cut with a screw thread and the nuts *h* turned up on them, after their insertion through the flange and plate. Two 1-inch angle irons *i* form the upper and lower members of the frame for the base and middle rail, as shown, and a 1-inch channel, extending full length of the sides and across the top of each panel, fastens the grilles and scrolls in their places. A smaller channel *k* rests on top of the plate *l* and receives the lower ends of the vertical members of the roof grille *o*. At *m*, another channel set vertically receives the upper ends of the vertical members of the roof grille, and also the ends of the straps forming the center ceiling panel shown at *l*, Fig. 43 (*a*). The straps of the dome and ceiling grilles are $\frac{1}{2}'' \times 1\frac{3}{8}''$ iron twisted as shown, and are riveted where they cross at *j*, as described in Art. **5**.

26. In Fig. 44 (*c*) is shown a section through the panel and guide at the side of the car, the line *a b* being the center line through the guides. The angle irons *d* are fastened to the flange of the **Z** bar at the bottom and to the $\frac{1}{4}$-inch plate at the top by means of small angle-iron knees, and a plate of sheet iron *e* riveted to the short legs of the angles forms the back of the chase or guide recess. On the inside of the car a mirror is fastened to this plate by means of $\frac{5}{8}'' \times \frac{1}{4}''$ angle irons screwed to the back of the chase with countersunk screw bolts.

27. An elevation of the sliding or folding gate, protecting the entrance to the car, is shown in Fig. 44 (*a*), while Fig. 44 (*e*) shows a large scale detail of the bottom of the

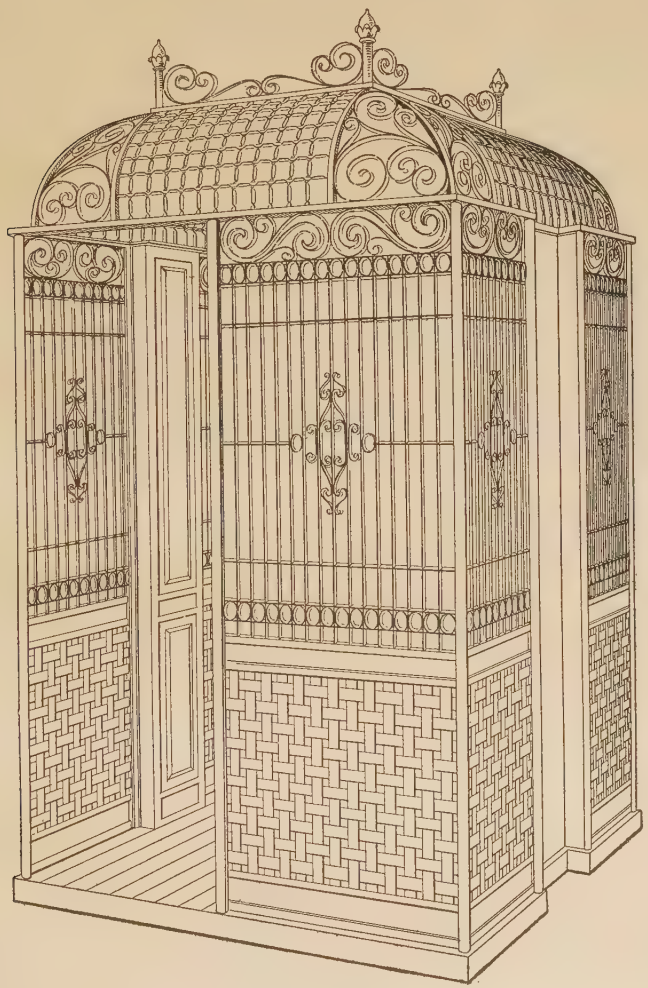
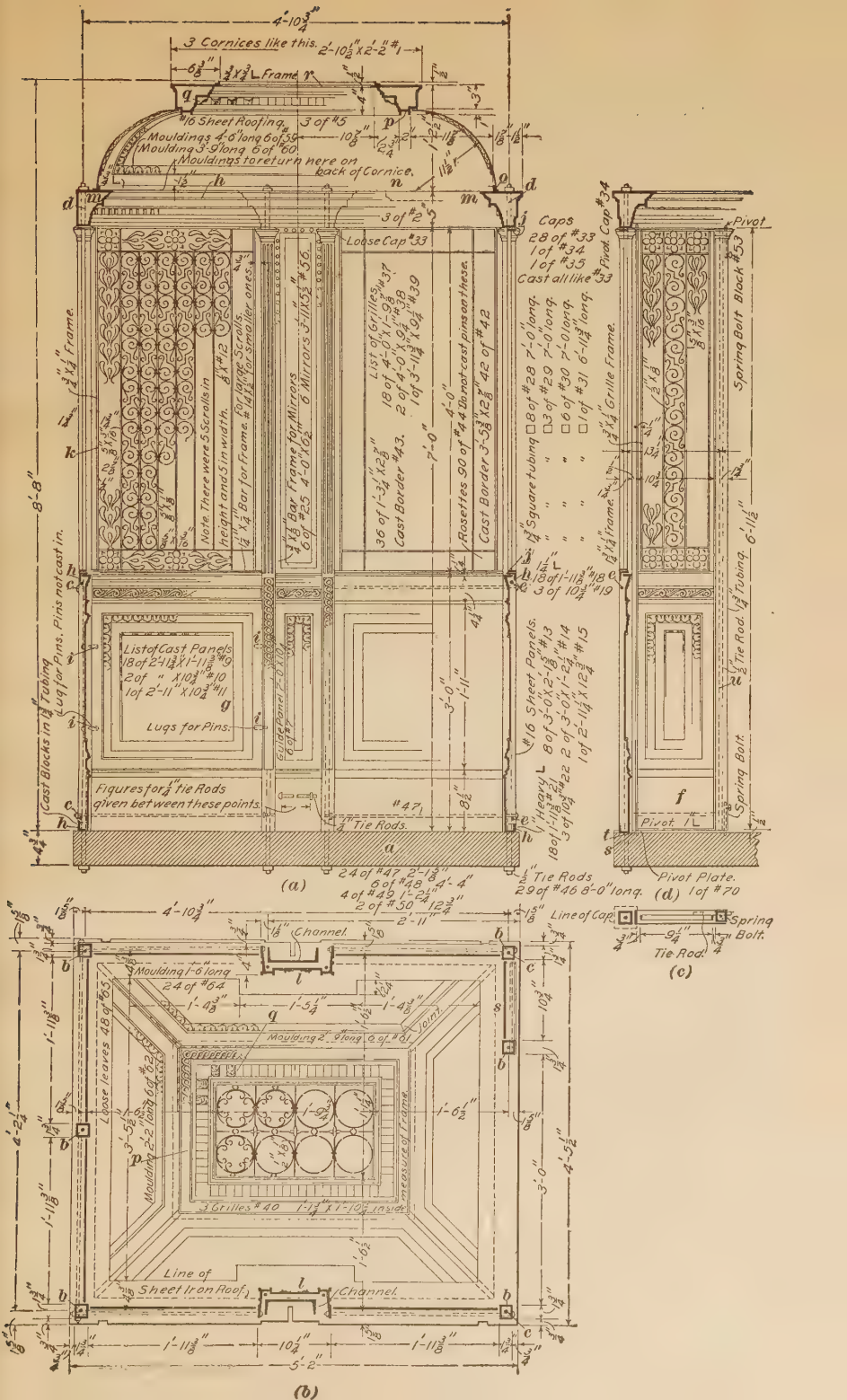


FIG. 45

sliding post of the gate *n* and the guide *o* in which it slides. The vertical members of the gate are each composed of a pair of $\frac{1}{2}$-inch channels, as shown at *a* in Fig. 44 (*f*), which is

an enlarged plan. Between these channels, the diagonal lattice bars *b* are secured as shown, with washers *c* between them to prevent their rubbing together as the gate is opened and shut. The rivets securing this latticework to the channels are not driven tight, but are left sufficiently free to play up and down in the slotted openings *a* shown in the elevation, Fig. 44 (*a*). Thus, the gate, which effectively bars the $2'\ 7\frac{3}{4}''$ opening in the car, occupies only the width of the seven vertical channels, or $3\frac{1}{2}$ inches when folded together so as to open the elevator. On the exterior channel, a $\frac{1}{2}'' \times \frac{1}{4}''$ guide is riveted, as shown at *n* in Fig. 44 (*e*), and on the under side of the **Z**-bar flange a track *o* is secured for the guide to travel in. At the top of the gate, the $\frac{1}{2}$-inch channels are carried up each side of the frieze grille of the car, as shown at *b*, Fig. 44 (*a*), and also in Fig. 44 (*e*), where the lower bar of the frieze grille is shown at *g* and the side bars or channels at *p*. The general appearance of the completed car with all of its parts assembled, is illustrated in Fig. 45.

28. In Fig. 46 is shown a reproduction of a shop drawing of one of these cars, which was to be one of several all constructed alike, and accounts for the excess of material stated on the drawing for the different parts. This car is designed for a similar disposition of tracks and guides as the last example, but the design is more elaborate. The bottom of the car shown at *a* in the interior elevation (*a*) is of wood; the upright framing is of square tubes, as shown at *b* in the plan (*b*), inside of which an iron rod *c* passes through the floor and the cornice *d*, and secures these parts as shown in Fig. 46 (*a*). The framework is bound together horizontally by rods at the rail and base, as shown in the elevation (*d*) at *e*, and by the cornice at the top. Similar rods are placed in the corners behind the projecting panels on each side, thus binding the whole car together. The top of the car is of sheet iron, and, being dome-shaped, is self-supporting. The sides of the car are of cast iron below the rail, and cast and wrought iron above, with a mirror on each side. The small section of front adjoining the door shown in the plan (*b*) at *s*


3 Cornices like this. 2'-10½" x 2'-2" #1
#16 Sheet Roofing.
Mouldings 4-6 long 6 of #58
Mouldings 3-9 long 6 of #60
Mouldings to return here on back of Cornice.
3 of #5
Loose Cap #33
Caps
28 of #33
1 of #34
1 of #35
Cast all like #33
Pivot Cap #34
Pivot
Spring Bolt Block #53
Grille Frame.
Tubing
Tie Rod
Spring Bolt
Pivot Plate.
Cast Blocks in ¼" Tubing
Lug for Pins. Pins not cast in.
Note. There were 5 Scrolls in height and 5 in width. Following Scrolls are smaller ones.
Bar for Frame #42
Bar for Frame #52
Bar for Frame #51
Frame.
Bar for Frame for Mirrors
6 Mirrors 3-11⅝ x 5-1⅝ #36
List of Grilles
18 of 4'-0" x 1'-9⅞" #37
2 of 4'-0" x 9⅞" #38
1 of 3'-11¼" x 9¼" #39
Cast Border #43.
36 of 1'-3¼" x 2⅛"
Rosettes 90 of #44 Do not cast pins on these.
Cast Border 3-5⅜ x 2⅛ 42 of #42
Square Tubing
Lugs for Pins.
List of Cast Panels
18 of 2'-1⅛" x 1'-11⅜" #9
2 of " " x 10¾" #10
1 of 2'-11" x 10¾" #11
Guide Panel 2-0 x 11¾
6 of #12
Figures for ¼" Tie Rods given between these points.
Tie Rods.
#47
16 Sheet Panels:
8 of 3'-0" x 2'-6⅛" #13
2 of 3'-0" x 1'-2¾" #14
1 of 2'-11¾" x 12¾" #15
Heavy L
3 of 10¾" #22
18 of 1'-11⅞" #18
3 of 10¾" #19
24 of #47 2'-1⅜"
6 of #48 1'-4"
4 of #49 1'-2¼"
2 of #50 12¾"
½" Tie Rods
29 of #46 8'-0" long.
1 of #70
(a)
(b)
(c)
(d)
Channel.
Moulding 1'-6" long
24 of #64
Moulding 2'-9" long 6 of #61
Joint.
Loose leaves 48 of #65
Moulding 2-2" long 6 of #62
3 Grilles #40 1'-1¼" x 1'-10¼" Inside measure of Frame
Line of Sheet Iron Roof.
Line of Cap.
Spring Bolt.
Tie Rod.

is made to swing inwards, to allow the use of the full width of the car in handling merchandise. The outside of the car below the rail is covered with sheet iron. The dado of the side shown at *g* in the elevation (*a*) is cast in one piece, including the base, panel, frieze, and cap. The base and cap are plain molded; the outside molding of the panel is decorated with a link leaf and the inner with a spool-and-reed ornament. The casting is fastened at the top and bottom by bolts through the angle irons *h*, which are framed in between, and bolted to, each pair of corner posts. At the sides, the panels are held by small lugs cast on them to receive dowel-pins, as shown at *i*, elevation (*a*). The top and bottom of the outside frames for the grilles shown at *j*, elevation (*a*), are made of $1\frac{1}{4}'' \times \frac{1}{4}''$ bar iron, and the sides *k* of $\frac{3}{4}'' \times \frac{1}{4}''$ iron. The inside frame dividing the cast-iron border and the grille is of $\frac{5}{8}'' \times \frac{3}{16}''$ iron, as shown; the bars of the grille are $\frac{5}{8}$ in. $\times \frac{1}{8}$ in., and the scrolls are all $\frac{1}{8}$ inch thick. The cast-iron border of the grille is a laurel-leaf design with a rosette in each corner and in the center of the top and bottom sections. The scrolls are fastened to the frame by rivets; but to the bars, they are held by straps. The cast-iron guide box, shown at *l* in the plan (*b*), is strengthened at the corners and finished on the inside with a pilaster, the upper part or shaft of which is fluted and finished with a cap, while the pedestal is paneled and filled with a guilloche ornament. The cornice is of cast iron, molded and ornamented with a dentil course, as shown on the interior elevation, while on the back it is finished with small moldings top and bottom, which return as indicated by the dotted lines *n*. The dome plates are mitered at the angles and paneled on the inside face. The miters are covered with bronze spool-and-reed moldings, and the panel molding is decorated with a leaf link. The dome plates are secured to the vertical leg of an angle *o*, which is riveted to the top of the cornice of the car; and the cast-iron cornice of the dome is supported by these dome plates. The soffit of this dome cornice is decorated with a guilloche, as shown at *p* in the plan, while its fascia and corona are supported on modillion brackets, as

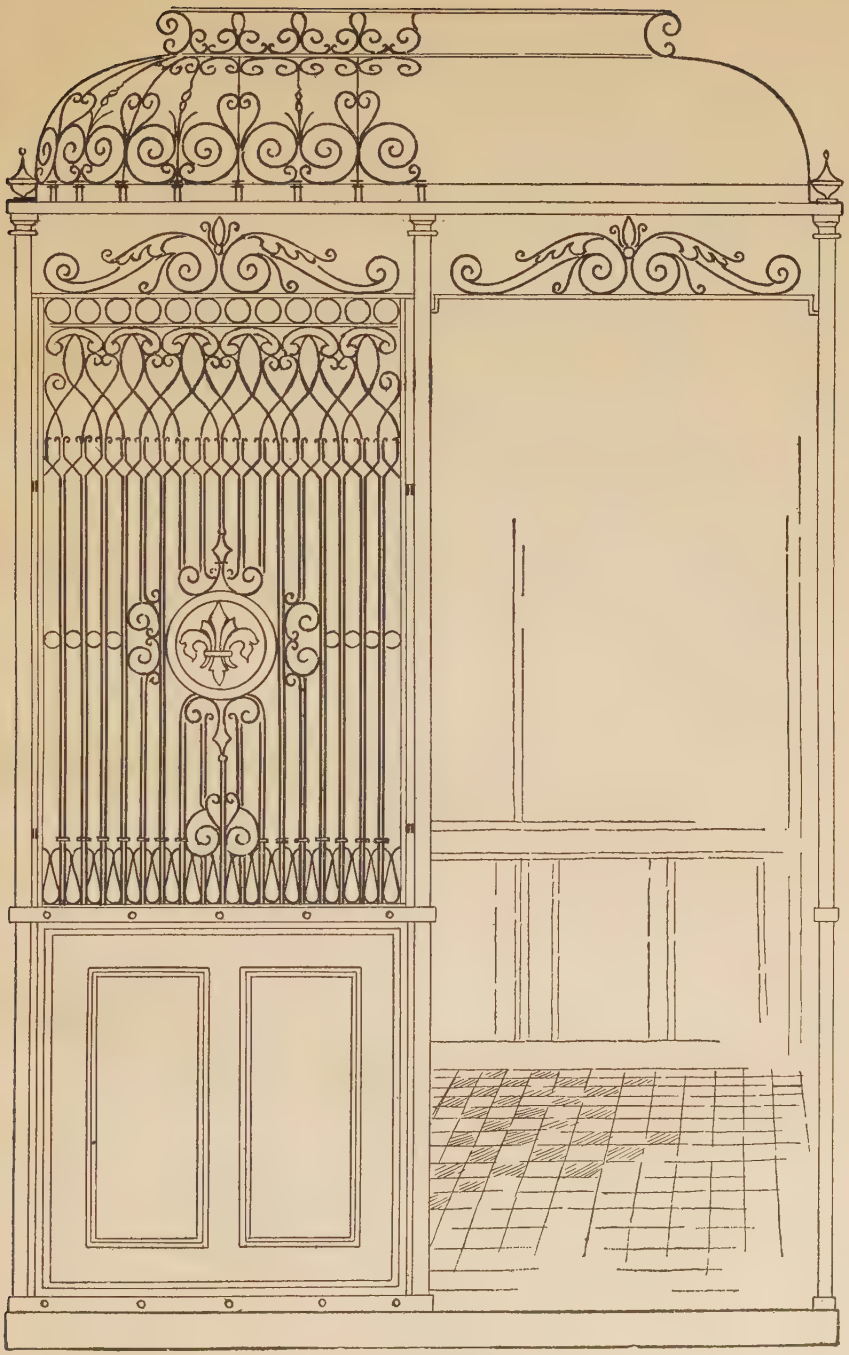


FIG. 47

shown at *q*. The dome grille *r*, elevation (*a*), is designed suggestive of the usual treatment of a ceiling, being first divided into panels, which are afterwards filled with a circle, and the circle with a quarterfoil of scrolls. This grille is set in an angle-iron frame, which is bolted to the cornice. The swinging door shown in the plan at *s* is seen in elevation at (*d*). The pivots *s* are riveted to the frame of the grille, the top one being inserted in the cornice and the bottom one in the pivot plate *t*. The top and bottom of the post *u* are fitted with spring bolts, which are withdrawn when the section is to be opened.

By a careful inspection of the details of the preceding examples, the construction of elevator cars should now be fully comprehended; and, as such work does not differ materially, there should be no difficulty in designing the construction details of any car required.

29. In Fig. 47 is shown a design for an elevator car entirely of wrought iron. The grille differs from the previous examples, as it has no border, but is divided into a dado, field, and frieze. The dado is composed of a series of oval scrolls, the field has a cartouch with a fleur-de-lis in the center, and the frieze is an interwoven pattern, surmounted by a series of rings. The panels that take the place of the cornice are filled with scrolls and decorated with leaves having a flower or bud at the center. The grille of the dome is in motive similar to the honeysuckle decoration used in classic architecture.

The car illustrated in Fig. 48 is of wrought iron, and the dado is a diaper of basketwork. The grille, by the arrangement of the scrolls, does away with a border top and bottom, but, as it is divided into three panels having the bars gathered reed fashion, it is necessary that a border be provided to close the space at the sides. The rods forming the reeds are separated by button washers and are riveted together. The dome of this car is circular in plan, and is divided into a series of radiating panels that finish at the bottom with a link-scroll design and at the top with rings. The crown of the dome has the scrolls so arranged that they form a natural continuation of the panels.

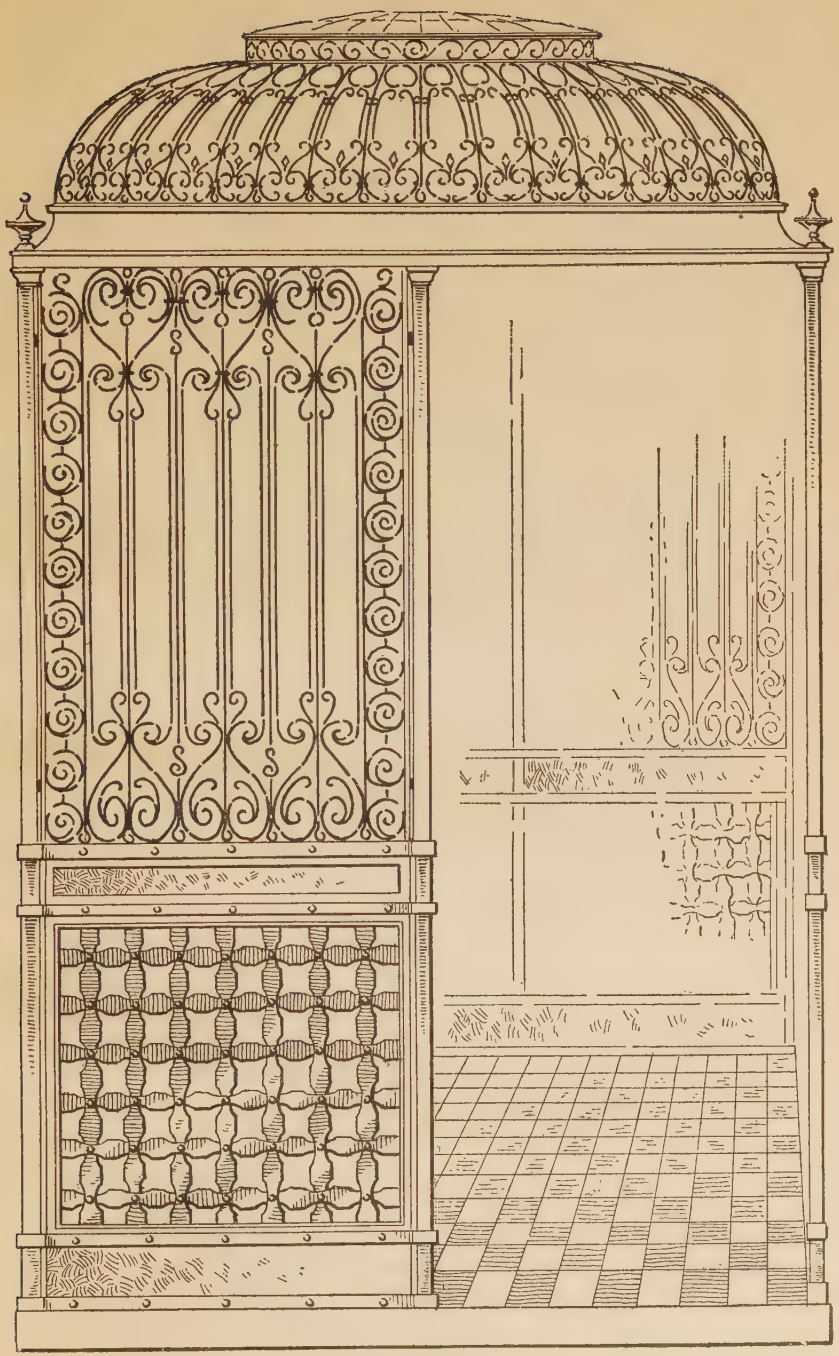


FIG. 48

LEAVES AND FOLIATED WORK

30. All the work considered up to the present time has been purely structural. Such ornament as has been necessary in elevator fronts or office partitions has been of a conventional character, and is confined to strap-iron grilles. Now, however, another kind of ornamental ironwork will be considered, namely, the execution of leaves and flowers in sheet and bar iron, by means of forging and working the metal. No machinery is required for this work, and to produce satisfactory results, a knowledge of designs, methods, and tools in use are indispensable.

In this branch of wrought-iron work, the designer should be intimately acquainted with his material; he should know how much working his metal will stand under certain conditions, and how much working his design will require to bring it into shape. He should know at what point and under what conditions forging will be necessary, how much of the work can be formed cold, and what details will have to be executed with the metal at a red or a white heat. Wrought-iron leaves are usually executed in sheet metal and hammered into shape; flowers sometimes require both sheet and bar metal; while designs of foliated grille-work require sheet, bar, and strap iron in varying quantities, according to the character of the work.

31. In Fig. 49 is shown a finished leaf as it would appear when permanently placed in position. To reproduce this leaf in iron, it will first be necessary to make a developed drawing of it—that is, a drawing of the leaf as it would appear if flattened out to the original shape of the metal when first cut out, before working in any manner. It is hardly possible to lay it out exactly—and in fact, such accuracy is not required, for, if the general dimensions are correct, the other parts may be worked into shape in subsequent

FIG. 49

operations. In Fig. 50 is shown the general appearance of the developed drawing. This drawing should now be carefully traced on the sheet metal and cut out. The crude iron leaf is then placed on a block of soft metal, such as lead, and cold-hammered into the general shape required. As constant hammering is likely to make the metal brittle and hard, it is sometimes necessary to anneal the iron in the forge several times before the leaf is finished. Special forms of hammers are used to shape the work. Two of these hammers are shown in Fig. 51. The one at (*a*) is flat on both faces, and is used in the general shaping of the leaf; while the one at (*b*), which has a spherical head, is

Fig. 50

Fig. 51

used to produce the curves of the lobes and indentations, and to bring the leaf to its finished form. The flared face opposite the spherical head is brought into service when sharp indentations or veins are to be formed, though for this purpose other tools and punches are also used in connection with the work.

32. In designing leafwork for a grille, a gate, or a railing, consideration should always be given to the appropriateness of its position in accordance with the utility of the device and the architectural style of the building. For instance, in the elevator cars and enclosures heretofore discussed, little or no consideration has been given to wrought-iron leafwork, because an elevator is essentially a utilitarian device, and such ornamental features as are expressed in its design should be a part and detail of the necessities of its construction. The grilled sides of the elevator are rendered

ornamental by simply twisting the iron straps and bars of the frame filling into geometrical forms; but where a grille is inserted in a transom light, or over a gateway, merely as a finish and ornament to the opening, the design may be elaborated with leafwork, as the purpose of the grille is not utilitarian but ornamental. Again, the heavy gates of a carriage entranceway require some leaf decoration to harmonize with the design of their surroundings, but they should at the same time preserve their identity as a purely utilitarian detail. The leaves and tendrils should not be delicately

FIG. 52

modeled in thin metal, but should be boldly hammered from sheet iron of from $\frac{3}{32}$ to $\frac{5}{32}$ inch in thickness. There should be no feeling of frailty in such a detail, and the ornament should be as strong and serviceable as the main structural details of the gate.

33. In Fig. 52 is shown the design of a panel suitable for a light railing, or a protecting grille in front of a glass screen.

The lines of the design are too delicate to permit of its use in a position where it would receive hard usage, and its details may therefore be of very light materials. The main framework, it will be observed, is composed of substantial bar iron, while the filling and leafwork is of very light gauge. The treatment of the panel shown in Fig. 53 is the

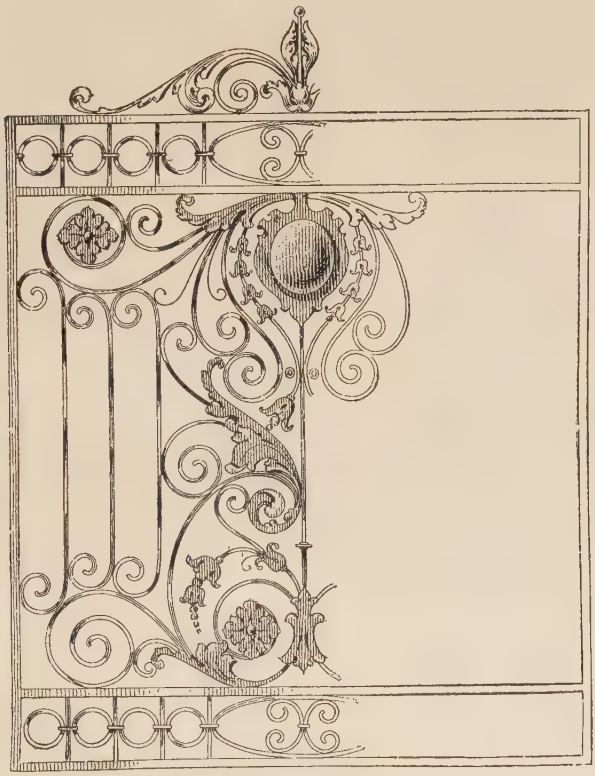


FIG. 53

reverse of this. Heavy framework filled in with substantially proportioned scrolls and bars forms the general scheme of the design, while the leafwork is applied to the parts where the scrolls unite, and thereby renders the points of forging more pleasing to the eye. The leafwork in this design plays no part in the structural strength, but renders

the structural necessities artistic, by combining and uniting them under an artistic form.

These two examples, Figs. 52 and 53, are intended to show the two principal conditions to be met with in leafwork design. Fig. 52 shows a framework full of ornament, possessing little strength and mainly serving an ornamental purpose, while Fig. 53 shows a strong frame and rigid grille-work, certain details of which are emphasized with leaf design. In Fig. 53, strengtn is the main consideration, and the ornament clothes the utilitarian details in artistic forms.

FIG. 54

34. In Fig. 54 is shown a piece of wrought-iron work that exceeds, in elaboration of design, anything heretofore considered. It is a design for one panel of a railing, placed in front of a window in a modern flat building, and is intended to be supported at each end by a heavy stone pier or pilaster. The top rail *a* and the bottom rail *b* extend from one of these posts to the other in an unbroken line, while the inner rail *c* is broken by the lines of the main scrolls, and is worked into a fret design in the corners. As the filling of this panel is nearly all leafwork, it follows that the leaves should be wrought in a heavy gauge of iron. The delicacy of the design will in no way be impaired by such treatment, as the parts should possess an appearance of strength sufficient to fulfil their several functions.

The main lines of the ornament in this design are composed of heavy iron bars, to which the leafwork is secured by forging. The double lines of the large scrolls forming the scheme of design at each end are filled in with a fret ornament of light iron. The iron of the main scroll being wider than that of the fret, the latter is protected from injury, but is raised from its support on button washers, in order that it may be more readily seen. The same may be said of the guilloche ornament on the left side of the center scroll, but the stem-and-bud ornament on the right side of the centerpiece is bent in place independent of the surrounding bars.

The leafwork is forged to the structural details as shown, and therefore seems to form a natural part of them, though

Fig. 55

the style of leaf is of a debased system of design. The example, however, serves to illustrate the extremes to which wrought-iron-work designs may be carried, and the tasks that a skilful workman may be called on to carry out.

Fig. 55 shows another design that, though less ornate in its leafwork, is equally complex in the arrangement and management of its scrolls. The main scroll lines break and change their direction suddenly, thereby leaving some points improperly secured, and necessitating other scrolls to hold them in place. The centerpiece is executed entirely in sheet metal, the drooping leaves being fastened to the surface of the vase with rivets. The main leaf of the scroll on the right-hand end of the rail is somewhat similar to the one shown in

Fig. 49, though larger. In this position, it forms an ornate finish to the panel, and at the same time serves as a floral calyx out of which the lower lines of the scroll appear to naturally grow.

FORGED WORK

35. In the succeeding pages, descriptions of the illustrations given cannot be more than general, as the principal object is to give examples that are standards of artistic and ornamental design. Instruction in smithwork has not been attempted, nor has it been deemed advisable to try to cover the complete field of useful and ornamental objects made in wrought iron, but to discuss only a small number of the ones more commonly seen and used in house building.

That a knowledge of the tools and the methods employed in working iron may be made known, and that the designs shown may thereby be better understood, the following short description is given: The few primary tools consist of a forge, an anvil, a pair of tongs, an ordinary blacksmith's hammer, a fuller, a set of punches (say three sizes each of square and round), three swage hammers, a set hammer, a flatter, and a riveting hammer. The fuller and the swage hammers are usually called *top swages*, as a duplicate of the hammer face, which fits in a hole in the top of the anvil, is called a *bottom fuller*, or *swage*.

The making of grilles and scrolls by bending and riveting is described under another head. Any two or more parts joined while hot are called *welded*, and all objects worked from a single piece are called *forged*. Whether welded or forged, the iron should first be brought to a white heat, and work commenced with the metal at this color, and continued until the iron assumes a deep cherry red, although, of course, this will depend somewhat on the grade of iron used. When the object to be welded or wrought is placed on the anvil, the blows at first should be light, and gradually increased in force as the metal cools, the forging would only be needlessly changed in shape by hammering not graduated in this way. This point may be appreciated by watching a good blacksmith at work.

To convert a section of a flat bar into a round one, the bar is brought to the proper heat in the forge fire and then laid across a bottom fuller set in the anvil, where, with a pair of tongs, it is held edge up, with the fuller hammer on the upper side. In this position it is indented until the approximate size of the round is made. The bar will now look as though it had a nick cut out of it on each side, the space between being the guide for the round part. The bar is again heated, and a bottom swage put in the hole in the top of the anvil, and the bar is placed on the anvil and worked to a rough round. It is then once more heated, and this time placed in the bottom swage, the smith holding the top swage in place while the helper strikes the top of it repeatedly as the bar is drawn between the swages, producing an even, smooth finish.

In the case of a fence railing or window guard, where the bars or pickets are to pass through the horizontal rails, and it is desired that the rails shall be of a uniform section where bars pass through, it is necessary that the rail shall be what is termed *upset*, that is, heated and driven together endwise to produce a bulge at the desired portion; or a small piece may be welded on at the point where each bar is to pass through to compensate for the metal punched out; the rail is then heated, and the required hole is made with a square or a round punch. After reheating, the rail is passed over the anvil and finished with the flatter to remove all the marks of the other tools.

If two bars are to be joined at right angles, they are placed one over the other at a white heat and welded together with a common smith's hammer, after which the slight bulging at the juncture is worked out. In especially fine work, a small piece is cut from each bar at the point of welding, though this is seldom necessary in ordinary practice.

Surface cuts, indentations, etc., for the production of diaper designs or patterns on plain surfaces, should be made at a low heat with fullers set in the bench, or anvil, as the case may require, a guide or spacer being so placed as to keep the work uniform and true. The finials of posts and knobs on fence bars are first roughly forged out by hand, and then

placed in a die under a trip hammer; or, where this is not at hand, the die is struck with sledges. When small work is welded, the tool marks are removed by the set hammer, which is simply a small flatter.

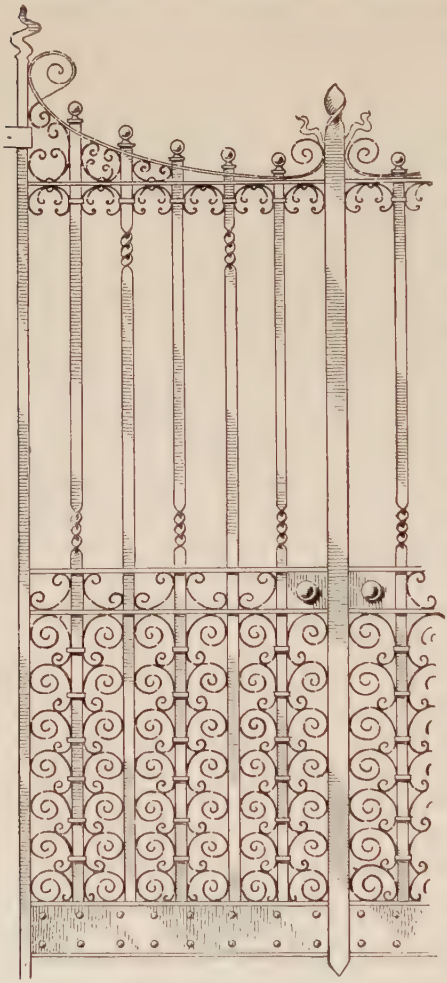


FIG. 56

36. In making festoons of leaves or flowers, or of both, a stem should first be made of the required length, and the pieces for the leaves cut from thin bar or strap iron, on which the individual stems of the flowers are welded. The shape of the leaf or flower is then worked out on a soft-metal block, as described for leafwork. When all the leaves and flowers are made, the main stem and a single leaf or flower are heated in the forge and welded together, this process being repeated with each leaf and flower until all are in place; they are then finished up and put in exact position or alinement after the metal is cold. When an object is to be forged out of a single piece of material, it is heated in the forge and worked under the hammer to the required shape or form; this is the most expensive part of wrought-iron work.

GATES AND FENCES

37. Most of the examples heretofore given have been of light work that could be made without heating the iron, but in Fig. 56 is shown ironwork of a more substantial character. The main bars are $1\frac{1}{2}$ inches square; the cross-bars are 3 in. $\times$ $1\frac{1}{2}$ in., wide enough for the uprights to pass through; and the scrollwork is of material $\frac{1}{4}$ in. $\times$ 1 in. When a bar is to be punched out, as in the horizontal members in this case, there should be ample metal left on each side of the hole punched to prevent the sides from spreading under the pressure of the punch and leaving the bar somewhat protruded at these points. The scrolls are alike in the lower part of the gate, and are fastened to the upright bars by a narrow strap on one side and a countersunk screw on the other. The hinge or hanger should be arranged at the top and made as shown in Fig. 57. The frame of the gate, which is a square bar, is rounded where the hinge clasps it, as shown at (*a*). The jagged part of the hinge is embedded in the stone piers or wall to which the gate is to be hung, and fixed in place with molten lead; or, where circumstances will permit, the bar is passed entirely through the wall and fastened on the other side with a large washer and nut. The gate is held by the clasp, which is secured with two bolts passing through the hinge bar, as shown at (*b*).

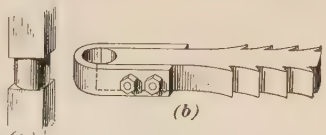


FIG. 57

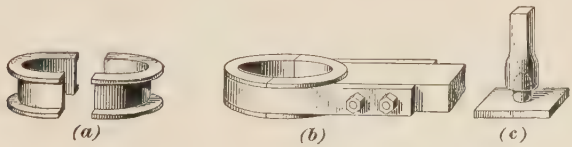


FIG. 58

In exceptionally high-grade work, the inside of the hinge is lined with a brass collar, as shown in Fig. 58 (*a*) and (*b*), which prevents the two surfaces from rusting when they are in contact. Nearly all gates, and especially heavy gates, are

pivoted at the bottom; and the pivot is usually formed at the lower part, or *heel*, of the gate itself, and fits in a socket under the gate. The objection to this method is that the socket is likely to fill with dirt and make it difficult to move the gate. A better way is to make the socket a part of the gate, and have the pivot separate, as shown in Fig. 58 (*c*). An oil hole may then be bored through the socket in an oblique direction to the pivot, which may then be oiled; and, as the socket is in the gate, the dust and dirt cannot get in and clog it up.

38. The railing shown in Fig. 59 is a good example of forged work, and illustrates the application of leafwork without detracting from the lines of the fence. The main uprights and the horizontal rails are clearly defined, and, as they should be, are much heavier than the bars and scrolls filling the panels formed by them. The fence is divided into large panels or sections, one of them being a double gateway. The first two upright bars at the end of the panels are carried up, forming posts. An increase in the size of these bars would be an improvement and further emphasize the post effect. The top of the post is finished with a finial ornament, and the gate as well as the side panels are finished with a cresting. The cresting of the gates is arranged to group them as one panel, and the main scrolls are decorated with leafwork. The top and bottom of both the gates and panels are well braced with an open rail having a scroll let in between. The scrolls filling the top and bottom of the panels are finished with a leaf-and-bud ornament, and the bars are braced by three rows of rings secured with straps and screws. The posts from which the gates are hung are braced with triangular foot-braces, and these as well as the posts themselves are leaded into the stonework.

The gate shown in Fig. 60 is a vigorous, well-balanced design, decidedly foreign in character, and including in the design of its transom a conventionalized eagle. The side panels of the screen, as well as the outside of the transom, are open and less elaborate than the central panels, the

contrast between them heightening the effect by separating the rich carving that existed on the stone architrave from the elaborate iron grille of the center. The transom bar is in four panels, each of which is filled between the border frame and lower rail with grille-work composed of crossed scrolls and decorated with leaves and rosettes. The continuation

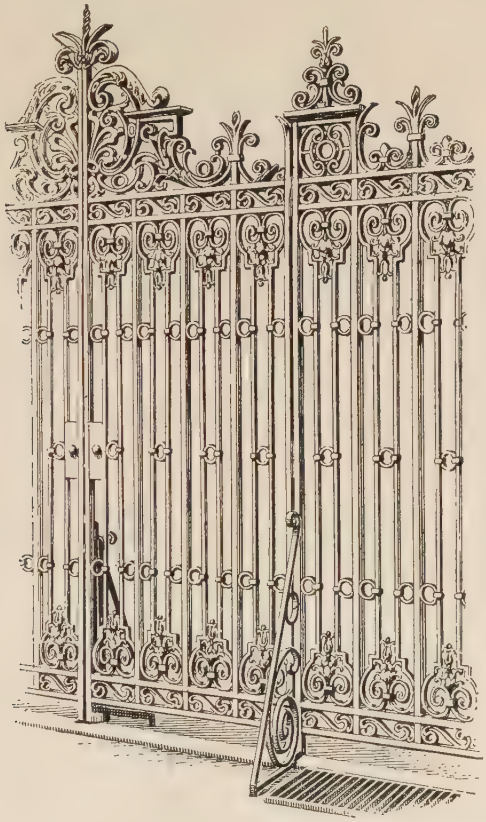


Fig. 59

of the principal vertical lines from the screen to the transom bar is accomplished by a console bracket, the top of which clasps the transom-bar rail. A point in this design that might be improved is the manner in which the inner frame of the semicircular transom border is carried down past the

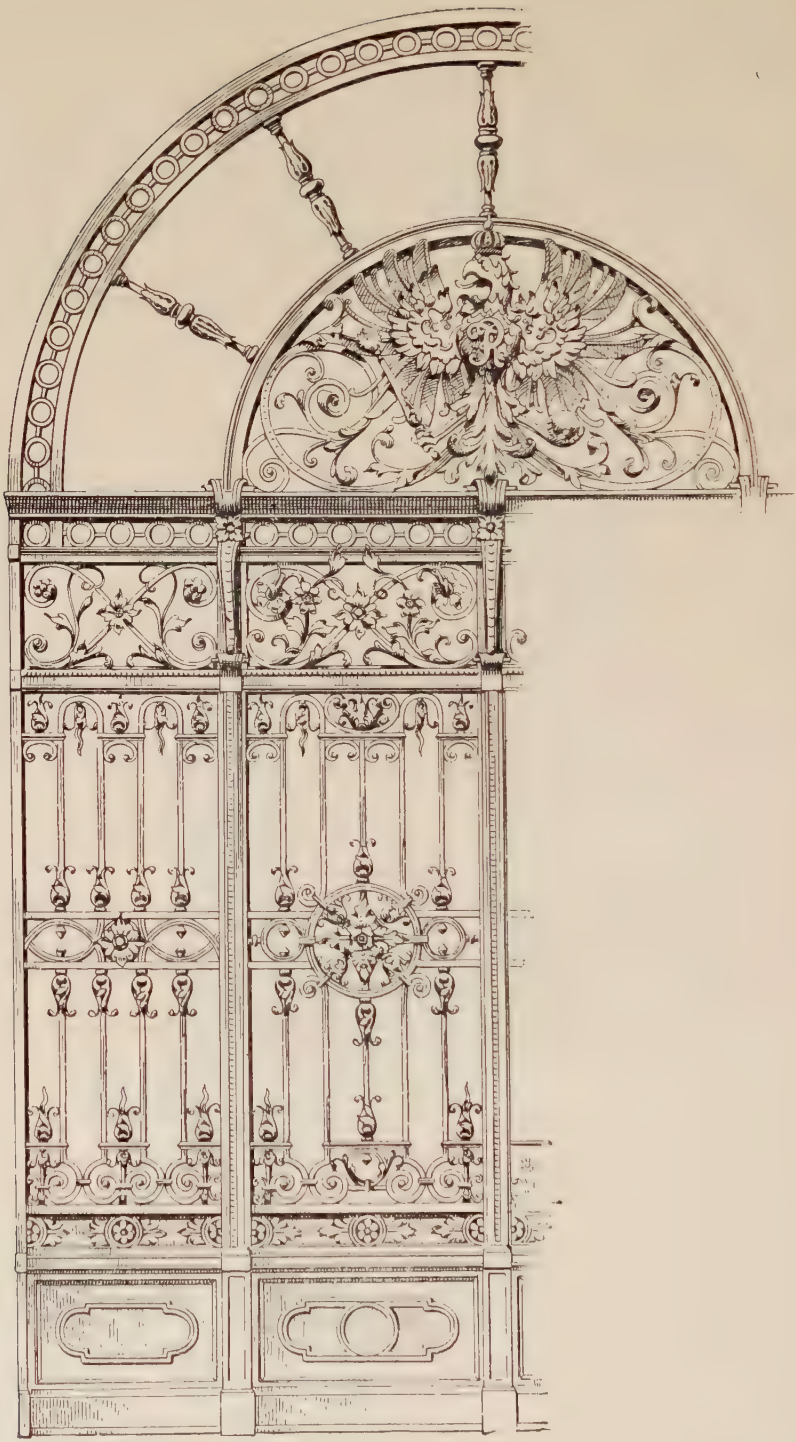


Fig. 60

top of the transom bar to the border frame, thus giving the idea that the transom frame is supported there; the omission of this piece of frame would considerably heighten the border effect and remove this weak appearance.

39. In Fig. 61 is an example of a small garden gate in cast iron, and, with the exception of the central shield and

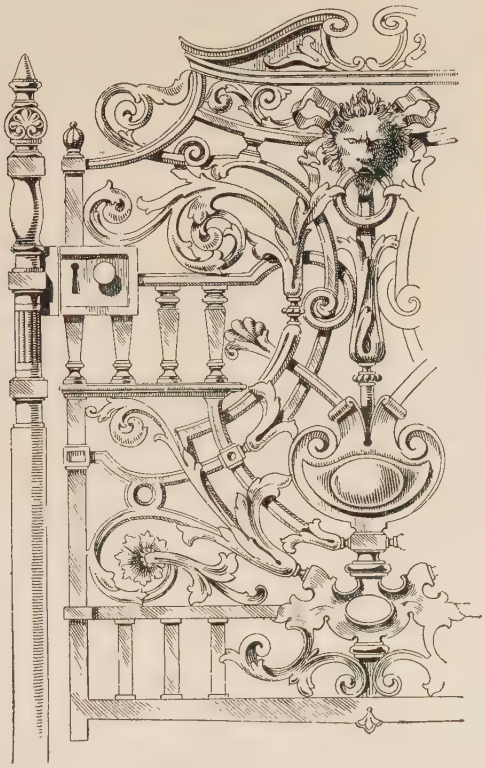


FIG. 61

the ornament at the top, all the members are kept approximately the same general thickness, to avoid any danger of cracking during the cooling stage. The parts that appear heavier on the face are thinned out to preserve the balance of metal. Cast iron for small work of this kind is inferior to wrought iron, as the effect of contrasting heavy and delicate

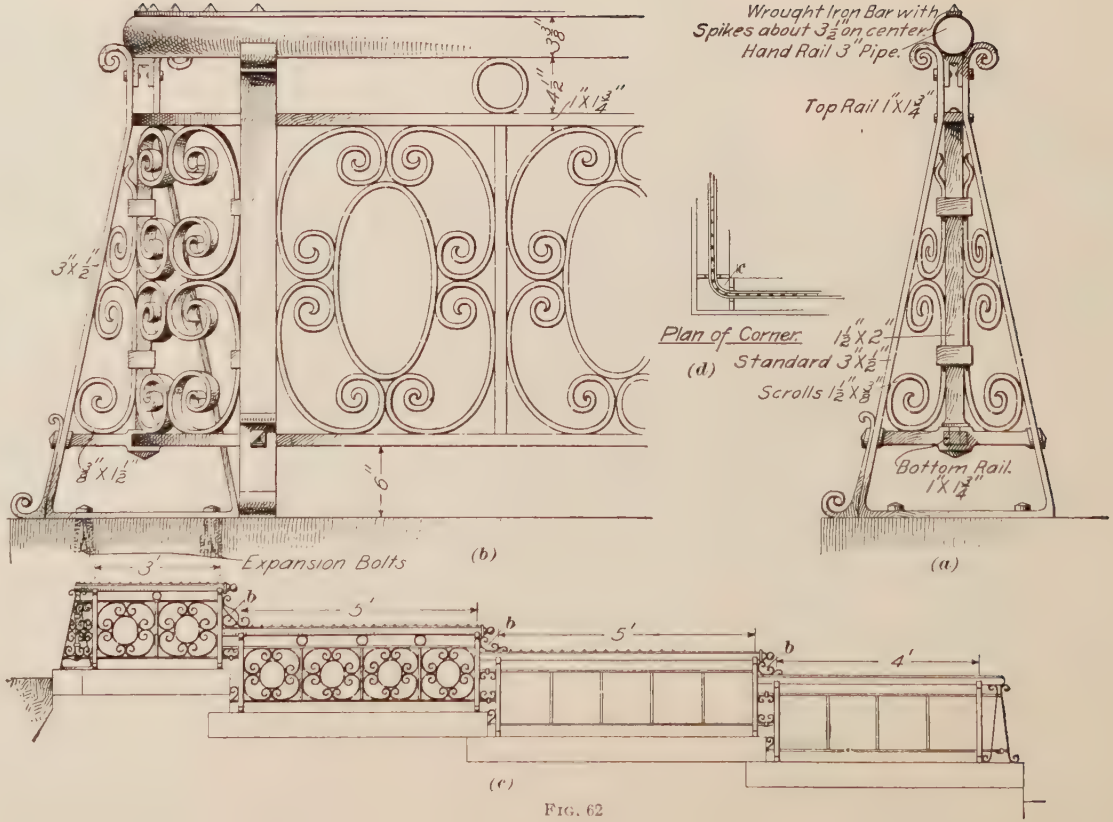

Wrought Iron Bar with
Spikes about 3½" on center
Hand Rail 3" Pipe.
Top Rail 1"X1¾"
Plan of Corner.
(d)
1½"X2"
Standard 3"X½"
Scrolls 1½"X⅜"
Bottom Rail.
1"X1¾"
(a)
3"X½"
⅜"X1½"
6"
Expansion Bolts
(b)
3'
5'
5'
4'
(c)

FIG. 62

features is necessarily somewhat wanting, owing to the limitations of the material.

The railing shown in Fig. 62 is a very massive and well proportioned one. The posts, or supports, are made triangular in shape, as shown at (*a*), and would almost retain their position without the aid of the expansion bolts by which they are secured to the coping, as shown at (*b*). This railing tops a stepped coping, as shown at (*c*), and is joined by easy and graceful scrolls at the point of the step *b*. The corners are arranged as at *c* in the plan (*d*), and the grille is bent to the radius formed by the intersection of the supports at their bases. The hand rail is a wrought-iron pipe finished at the ends with a knob ornament, and the top has a bar studded with spikes to prevent lounging.

WINDOW GUARDS

40. A **window guard** should be primarily a protective device, and secondarily an ornament or decoration. As a rule, especially in private-residence work, the design of these very necessary features is not given a proper amount of attention, but they are certainly as deserving of careful consideration as any other ironwork of the structure. They may be made to form the divisions of the window opening in place of the bars of the sash, and to produce the desired effect of window subdivision, at the same time leaving the glass in any required size. It is not necessary that a window guard shall be flat, nor set between the jambs of the window opening; it may be a roomy addition to the window sill, fastened to the walls on either side of the jambs, wherein summer flowers may be placed to blossom in the sun and receive protection from high winds or careless hands. Small openings for ventilation or light may be rendered pleasing by simple and effective guards, such as those shown in Fig. 63 (*a*), (*b*), and (*c*), cut out of single pieces of iron.

The guard shown in Fig. 63 (*d*) is a clever piece of forging, and illustrates what simple and yet refined design may be executed in this class of work. The upper and lower

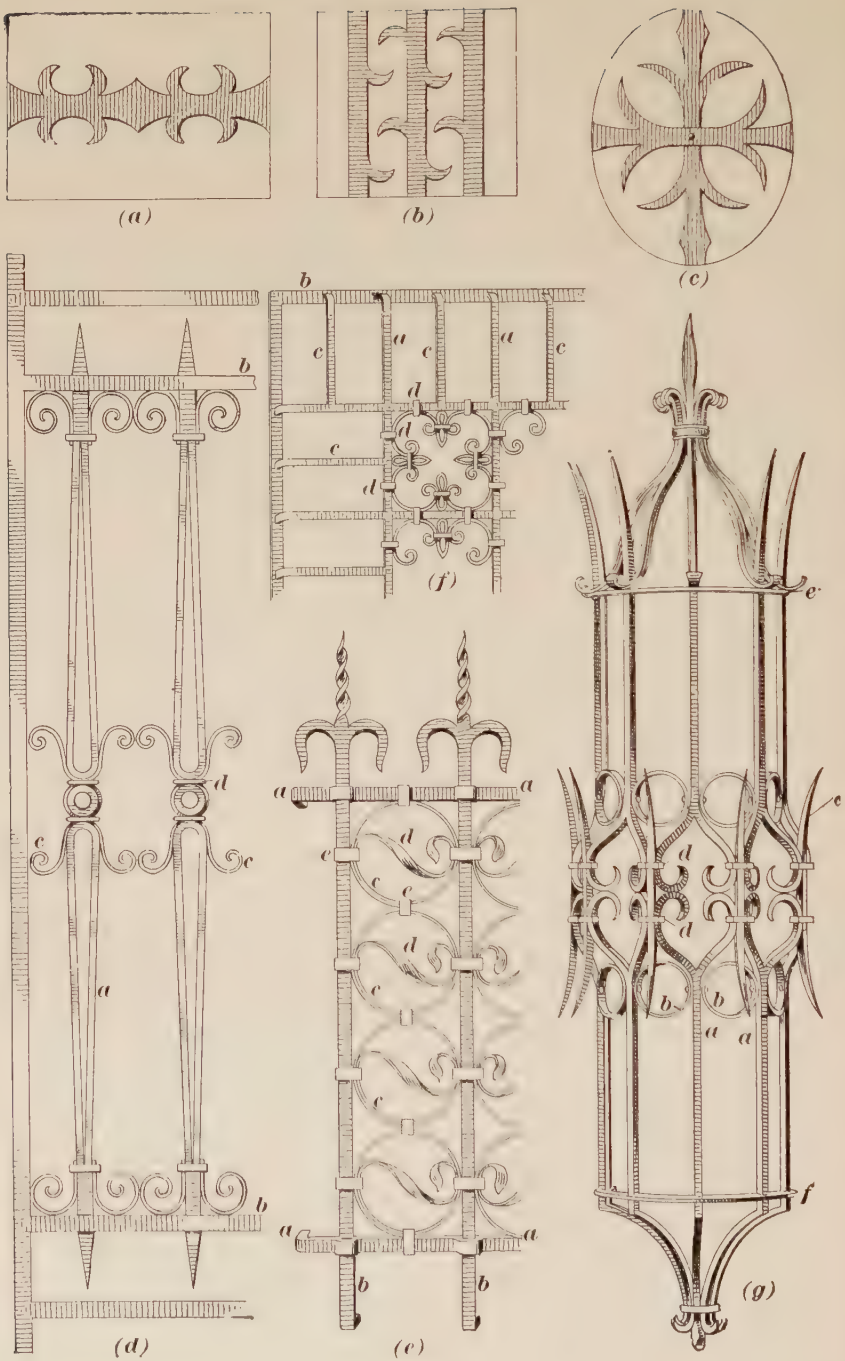


FIG. 63

parts of the bars *a* are made by bending the iron into long open loops as shown, the ends being carried through the rails *b*, a ring forged between the two interior ends, and the scrolls *c* forged to the bars and ring; the clip, or clasp, *d* encircles both ring and scroll, and binds them together.

The design shown in Fig. 63 (*e*) is very old in style, and is made to fasten to the face of the walls surrounding the window opening, the rails *a* and bars *b* being provided with return ends, which are let into the stonework about 6 inches from the edge of the window opening. The rings *c* forming the grille in this design are carried about a quarter-turn past the full circle, and the iron is twisted and flattened out in the center to form a leaf scroll *d*, which, with the rings and bars, is held in place by the flat clips *e*. The bars are drawn out and cut into three prongs at the top to form a cresting, the center one being twisted and the other two bent down to give ample protection to the top of the opening.

The design shown in Fig. 63 (*f*) is constructed for use either on the wooden window frame or on the face of the wall surrounding the window. The bars *a* forming the large square mesh are welded together, and extend beyond the mesh a distance equal to its width, and are then bent back 4 inches and welded to the frame *b*; intermediate pieces *c* are set between them, and a border is thus formed. The angles of the mesh are filled with scrolls as shown, which are held in place with flat clips *d*.

41. The guard shown in Fig. 63 (*g*) is an example of how effectively iron may be employed in decorating an otherwise plain opening, and transforming it into one of the attractive features of a house front. This guard is intended to cover a small window opening, which would almost escape observation without it, and certainly add nothing to the design of the building, though necessary for lighting the interior. This guard is made up entirely of different sizes of bar iron. The principal feature is the manner in which the bars *a* are divided just above the circles *b*, which are riveted to them, the divided portions being wrought into scrolls,

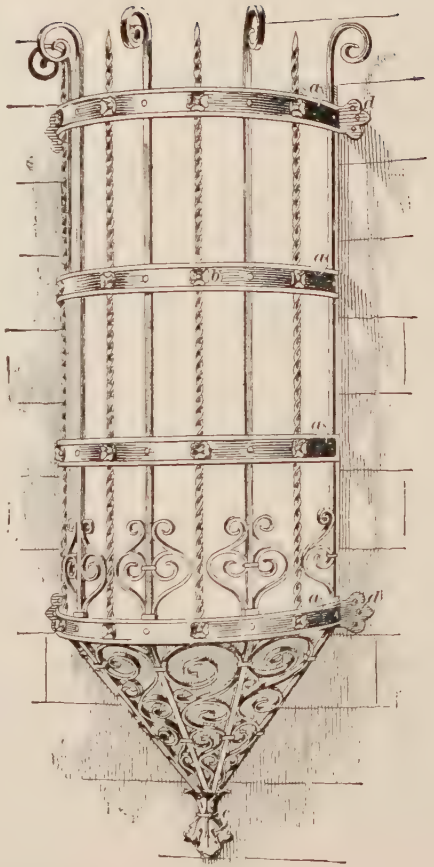


Fig. 64

Fig. 65

which are welded to the spikes *c*, and are further bound by the strap clips *d*. The tops of the bars are finished with spike points, passing through a band *e* and through the bars forming the top, and are welded together. The guard is attached to the opening by the ends of the bands *e* and *f* bent to form lugs, which are calked with lead into holes cut for them in the stone jambs.

In the guard shown in Fig. 64, the horizontal bands *a* not only greatly increase the protection, but, with the ornamental studs or rosettes on their faces, add much to the decorative effect. These studs *b* are riveted on over each twisted bar. The edges of the bands are turned over, forming a border or flange, strengthening and giving them a finish. The twisted bars terminate at the lower band, and the plain bars are carried down, all meeting in a point, where they are welded together and covered at the junction with a leaf ornament *c*. The twisted bars are pointed at the top, and the plain ones are finished with a scroll. The entire lower portion of the guard is filled with a scroll grille, and a dado of scrolls is filled in between the bars above the lower band. The guard is fastened to the stone with expansion bolts let into the stonework through the ornamental bolt plates *d*.

42. The design shown in Fig. 65 has many points in its favor from both a structural and an ornamental standpoint. It is constructed almost entirely of forged bar iron, with just sufficient leafwork to relieve the monotony of single lines. The design is so open that the interference with light, ventilation, or outlook is inconsiderable; but at the same time it is strong, secure, and well adapted to its prime purpose as a guard. The presence of the leafwork in the upper part gives this device an appearance of lightness and delicacy, but observation will reveal that behind these leaves heavy wrought bars give the strength that the purpose of the device requires.

43. The preceding window guards are all designed for the purpose of preventing access to the building, where the windows can be easily reached from the outside; but guards

are also placed across window openings at the higher stories where the sills are very low, to insure safety against the possibility of any one falling therefrom. They are used also merely as part of the ornamentation of the façades of buildings, although this practice is hardly defensible. Figs. 66 and 67 belong to this class, the former being entirely of wrought iron. Fig. 67 is mostly of cast iron with wrought-iron framing bars. The two main posts are doweled

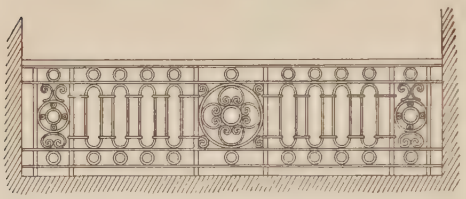


FIG. 66

FIG. 67

into the stone sill, and the top bars are screwed to the iron window jambs at each side. It is made thoroughly rigid by being braced back to the two mullions.

BALCONIES

44. Balconies of stone or of wood often add to the appearance of a building, but they lack the light and graceful effect of those made of iron.

In Fig. 68 (*a*) is shown a light balcony very simple in design, that is made entirely of wrought iron. The floor is composed of flat bars spaced 1 inch apart. Along the face of the wall is a light angle iron, which is bolted to the stonework. The front and ends are formed of 6-inch channels supported on brackets, as shown in Fig. 68 (*b*), the face of the channels being relieved by a small molding. The railing is composed of $2'' \times \frac{1}{2}''$ horizontal bars, $\frac{3}{4}$-inch square

vertical bars, and $\frac{3}{4}'' \times \frac{1}{4}''$ scrolls; it is capped with a $2\frac{1}{2}$-inch brass-pipe rail resting on a 2-inch channel. The corner posts are $2\frac{1}{2}$ inches square, surmounted with a brass ball.

Balcony work, like all other ornamental ironwork, has a wide range, and embraces every design from the simple one just described to the massive continuous example shown in *Ornamental Metal Work*, Part 1. The railings may be straight

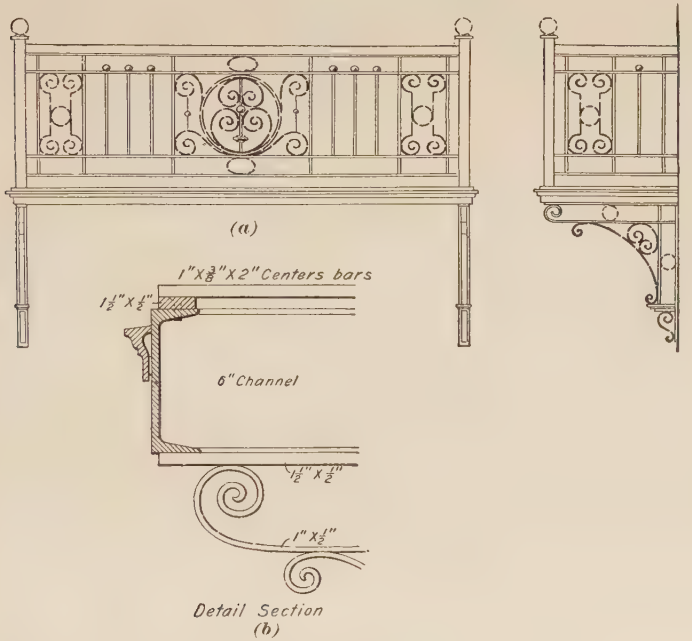


FIG. 68

or curved, plain or foliated, according to the demands of the building they are to adorn. It will be noticed that several of the grilles and panels shown can be used as balcony railings, some without any alteration to the design at all.

LAMPS AND BRACKETS

45. For exterior and interior lamp posts and brackets, wrought scroll-and-leaf work lends itself most readily. There is no detail of house furnishings wherein wrought iron can

be put to such effective use in decoration as in electric and gas fixtures. The necessary presence of the wire conduit or gas pipe forms the purely utilitarian element of the design, and is so easily disposed of that the designer may devote nearly all his energies to the perfection of the ornamental details and the grouping in the composition. It may be well also to state that in addition to the ironwork itself another consideration materially affects this style of design, and that is the forms of electric lamps and globes with which the fixtures are to be furnished. Electric lamps may be obtained in all sizes and styles, from the large 300-candle-power, strictly for commercial use, to the small single- and half-candlepower globes used for decorative purposes. The latter are frequently mounted on the end of white-glass tubes blown in representation of wax candles, a number of which are grouped in one candelabrum or bracket, diffusing the soft unobtrusive glow of old-fashioned candle light, without the offensive grease, smoke, or smell. Again, these same diminutive lamps are enclosed in china globes representative of various flowers, such as the rose, lily, morning glory, etc., and the bracket that supports them is correspondingly designed to suggest the details of the foliated bush or vine.

46. The lamp in most common use is the 16-candle-power size, and Fig. 69 shows the neat arrangement of one

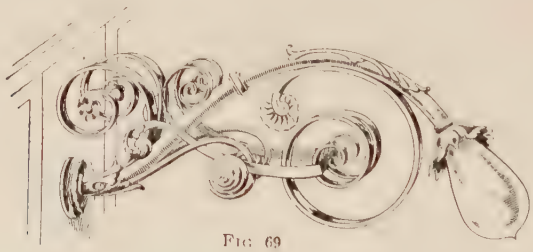


FIG. 69

of these globes at the end of a wrought-iron wall bracket. The design is extremely simple; the tube containing the wires extends in a curve from the wall to the lamp. Iron scrolls appear to emerge from the small foliated wall plate with the tube, and help support it on the outside, while the

lamp is so set that its light will not cast the shadow of any part of the fixture.

Fig. 70 shows a similar design, somewhat more ornate, though precisely the same in principle. The tube, or conduit,

FIG. 70

forms, as it protrudes from the leafwork, the main stem of a floral device, from which scrolls branch out at each side, and at the termination of which is the blossom consisting of a 16-candlepower lamp, surrounded by a calyx of wrought-iron leaves. The essential points of difference between Figs. 69 and 70 lie in the fact that the former consists almost entirely of strap-iron scrolls, while the latter is primarily a foliated design the scrolls of which exist as a part of the floral composition, and do not, as in Fig. 69, form the structural scheme of the design. The long wall plate in Fig. 70 renders this bracket much stiffer than the former one, particularly as the scroll on the curve of the conduit tends to tie the wall plate and bracket in two places. The scrolls in Fig. 69 might serve a similar purpose, but not without impairing the desired effect of a single tube springing abruptly from the wall surface.

FIG. 71

47. In Fig. 71 is illustrated a combination bracket designed for both gas and electric light. Here the wall plate is much heavier, and though the general scheme of design is similar to the example shown in Fig. 70, the leaf and ornamental work is heavier, as is required by the presence of more electric lamps and a gas globe. The main tube, or conduit, contains both the electric wires and the gas pipe, and as it terminates in a spray of four lamps and one gas jet, it must appear sufficiently strong and well proportioned to carry these details successfully; hence, the extra leafwork to give its body bulk and weight, together with the scrolls that appear to support it from above. Behind these is the wall plate that apparently carries the weight of all, and is therefore made bold and substantial in proportion to the work it has to do.

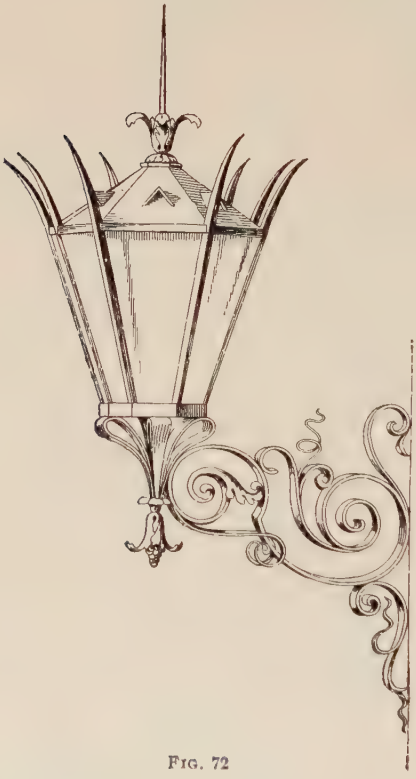


FIG. 72

48. Bracket and gate lanterns of various forms are used on the entrance posts flanking a gate, or are suspended over the gate by means of a scrollwork arch. Fig. 72 shows a bracket lamp, the body of which is made of sheet iron and glass. The pyramidal sheet-iron roof — or *canopy*, as it is sometimes called — is pierced by eight small ventilators and is finished on top with a foliated finial. The scrollwork connecting the lantern to the wall is composed entirely of strapwork, and is secured to

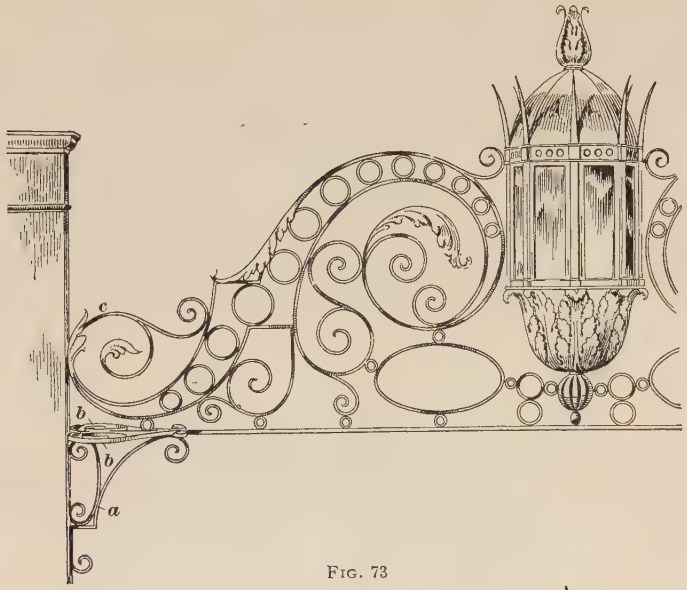


FIG. 73

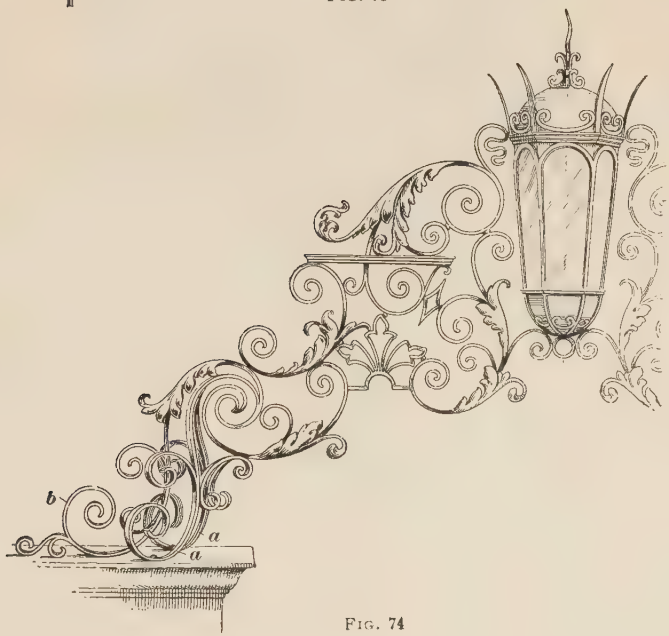


FIG. 74

the masonry by means of expansion bolts. Strength and simplicity are the fundamental principles to be looked out for in this class of work.

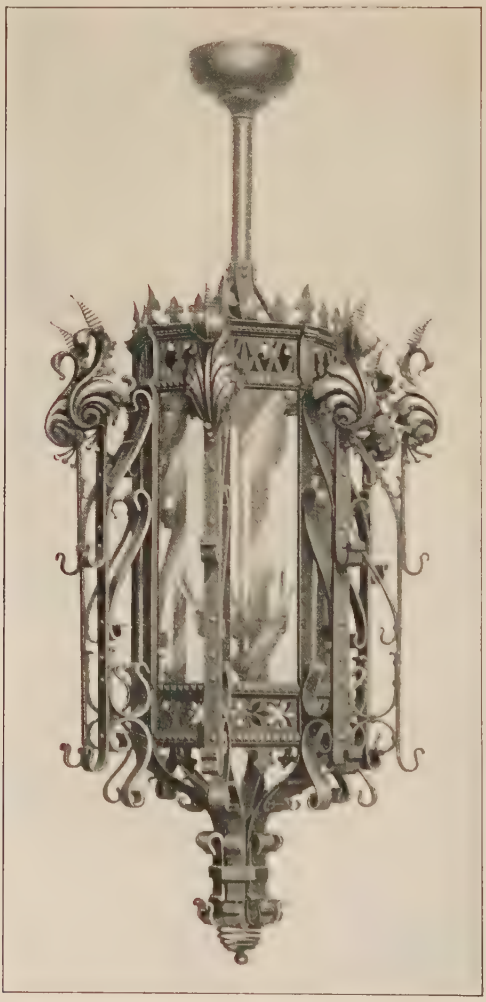


Fig. 73

The gateway lanterns shown in Figs. 73 and 74 are made of a combination of cast, wrought, and sheet iron. The

design shown in Fig. 73 is intended to be placed between gate posts, and is provided with the bracket scrolls *a* to distribute and support the weight with the scrolls *b* to brace the grille laterally, and with the scroll *c* to prevent any tendency toward a rotary movement. The iron arch in Fig. 74 is designed to rest on the top of gate posts, and the scrolls *a* are so arranged at the foot of the arch that they prevent any lateral movement or tendency to revolve, the weight being well distributed and also a firmer hold being obtained by extending the large scroll *b*.

49. A very beautiful design of a wrought-iron pendant lantern is shown in Fig. 75. It is intended to hang under an archway or any similar position. It will be agreed that the primary use of a lantern is to shed light; and if this were all, then such a design as here shown would not fulfil the condition to the best advantage. But this is not all. Lights may be very properly used decoratively as well as for purposes of illumination, and this is a case in point. The light serves the purpose of marking the middle of the archway, and since that is all that is desired, the designer has felt able to elaborate and beautify the inner case by the addition of sprays and bands with graceful, hammered leaves. This is another illustration of what has already been stated, to the effect that the successful designer should constantly bear in mind, not only the individual article he may be engaged on at the moment, but its real object, whether entirely utilitarian or partly decorative, and its relation to its environment.

LAMP POSTS

50. Brackets and hanging lanterns, however, cannot be used in every case, and naturally the next form to suggest itself is that of a post, or column, which may be either a single shaft or a central shaft with clusters of brackets surrounding it. These posts may be short or long, slender or massive, sometimes forming the termination of the stone posts of a gateway or may be in the shape of a candelabra set on the stonework of an entrance. Fig. 76 illustrates an example of the former while Fig. 77 shows the candelabra type.

51. Fig. 78 shows a form of lamp post, the design of which is suggestive of a giant candelabrum. The base and shaft of cast iron are octagonal in plan, and support the three spherical globes containing the electric lamps. The arms supporting the globes are simply designed with just a suggestion of foliated work in the details. The globe may be of opalescent or ground glass, in order to diffuse the light from the electric lamps within, of which there may be three or more to each globe, according to the illuminating requirements. This style of lamp post is frequently used as a luminant for the porch of a private residence, hotel, or club, but for street lighting where the arc light is used, a different form of post is required, owing both to the difference in the form of the lamp and to the care attendant on its maintenance. Fig. 79 shows the style of support suitable for the latter case. It is executed in cast iron, as was the design shown in the previous example, but owing to the difference of its purpose the entire character of the design is changed.

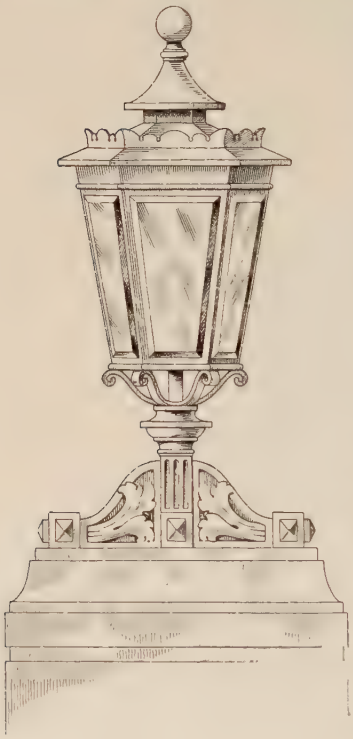


FIG. 76

In the first place, the post shown in Fig. 79 is much heavier and bulkier than the one in Fig. 78 for the reason that it is likely to receive somewhat rough usage from passing vehicles or careless draymen. Posts for street use should never be made so slender as to be easily broken. The upper portion of the post shown in Fig. 79 is designed as a loop or wicket, in which the arc light hangs under a protective roof, or hood.

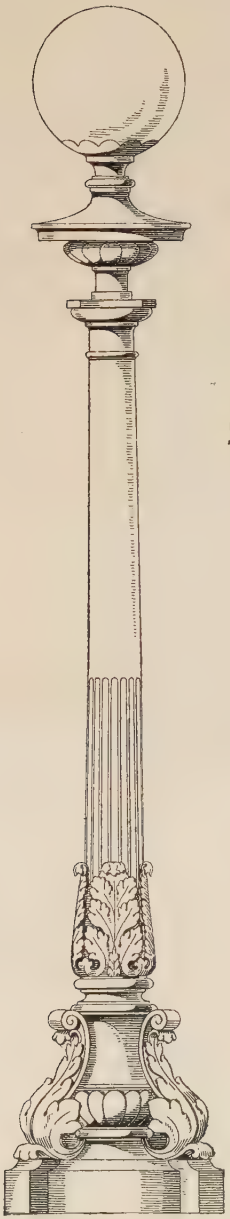


FIG. 77

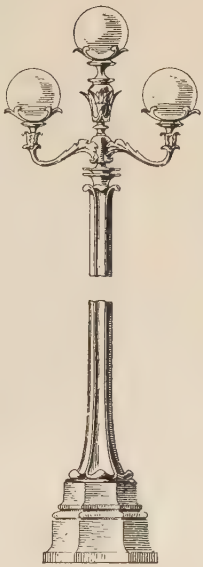


FIG. 78

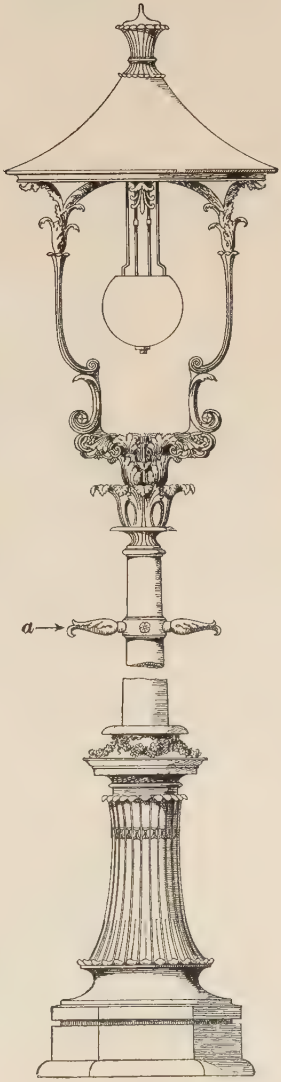


FIG. 79

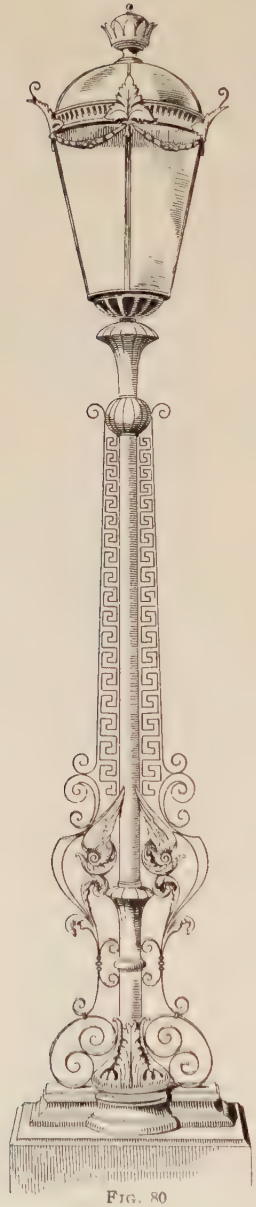


FIG. 80

FIG. 81

Thus it is seen that its exposed position requires the street lamp to be heavy and strong, and that the character of the light it carries determines the form of its top, while the maintenance of the arc light requires the two projecting rungs *a* against which a ladder may rest or on which a person may stand when adjusting new carbons or cleaning the globe and copperwork.

52. In Fig. 80 is shown a form of post for a gas lamp. The main shaft, or post, is of cast iron, on which the fretwork and scrollwork of wrought iron is secured with countersunk screws. The lantern at the top consists of glass plates mounted in a wrought-iron frame, which is covered with a dome-shaped hood. This lantern encloses the gas jet or jets and protects the flame from the wind. The scrollwork of this design is so delicate that it is hardly suited for a much exposed position, such as a street light, but for courtyards and lawns or for park walks it is admirable, combining delicacy and refinement of design with simplicity and economy of construction.

The lamp shown in Fig. 81 is an elaborate design in cast and wrought iron, and is suitable as a porch light or as one of a series of lights arranged in a courtyard. The main body is of cast iron, decorated and relieved with wrought-iron leafwork, which is secured to the cast-iron standard with countersunk screws. The design is suggestive of an antique, standard, and torch; only, where the flame of the torch would have existed in ancient art, the globe and electric lamp are present here. The globe in this case should be of opal or ground glass, for reasons similar to those stated in connection with Fig. 78.

CANOPIES AND PORCHES

53. Of canopies, marquees, porches, etc., there is endless variety. They are peculiarly adapted for execution in wrought and cast metal, and may be seen in all sorts of forms—fan- or dome-shaped tops, with and without brackets, curved or straight roofs, sometimes projecting out over the sidewalks to the edge of the curb.

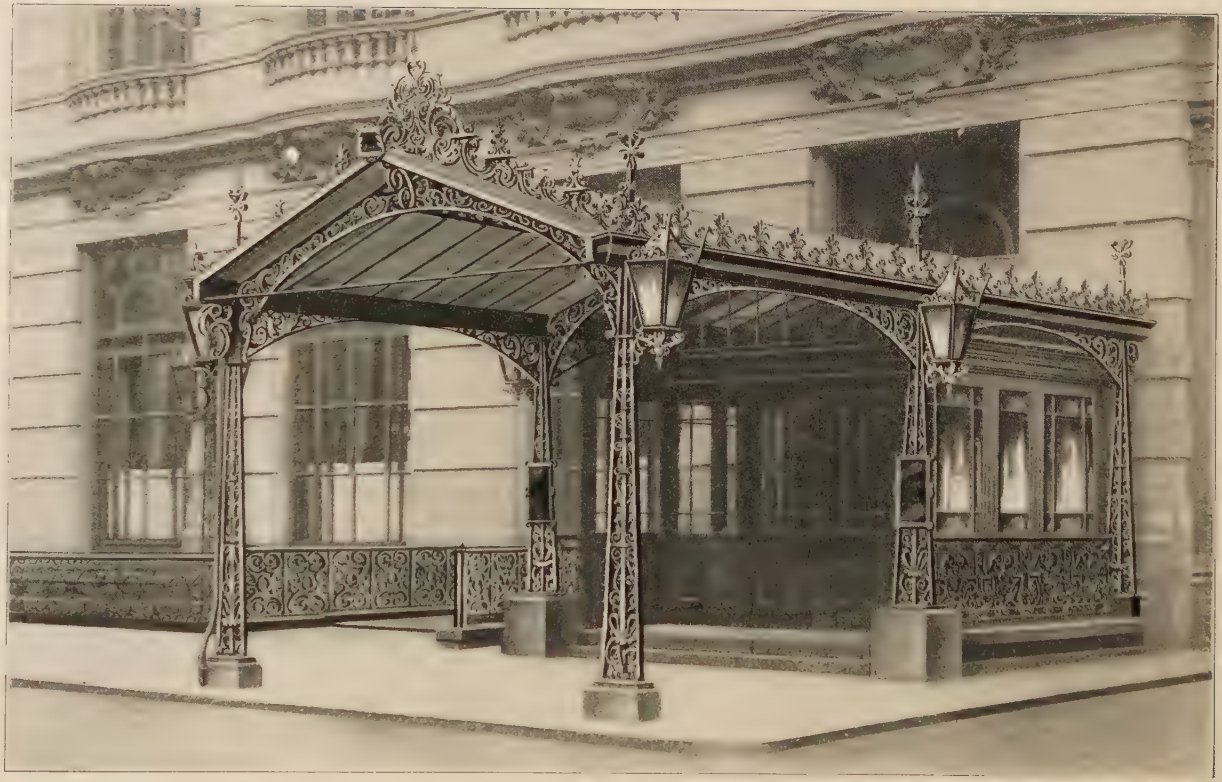
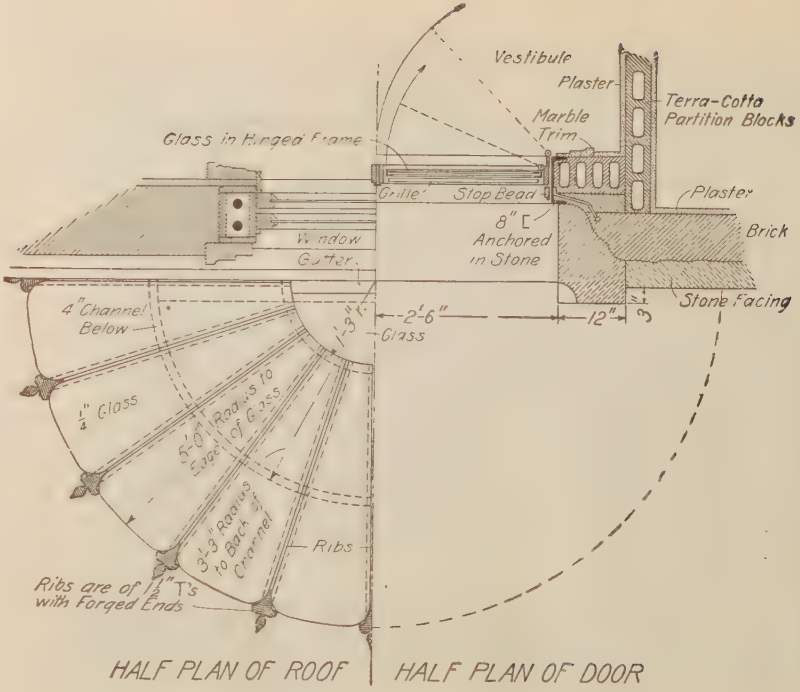
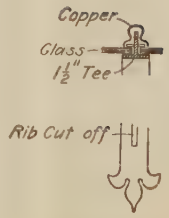
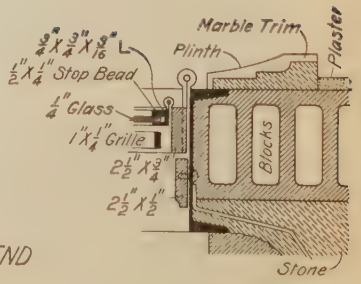
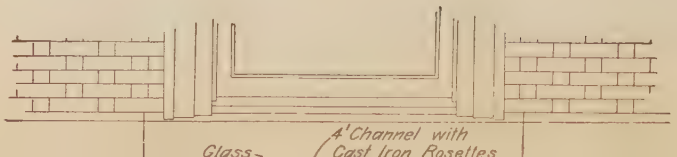


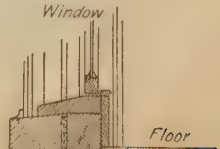
FIG. 83

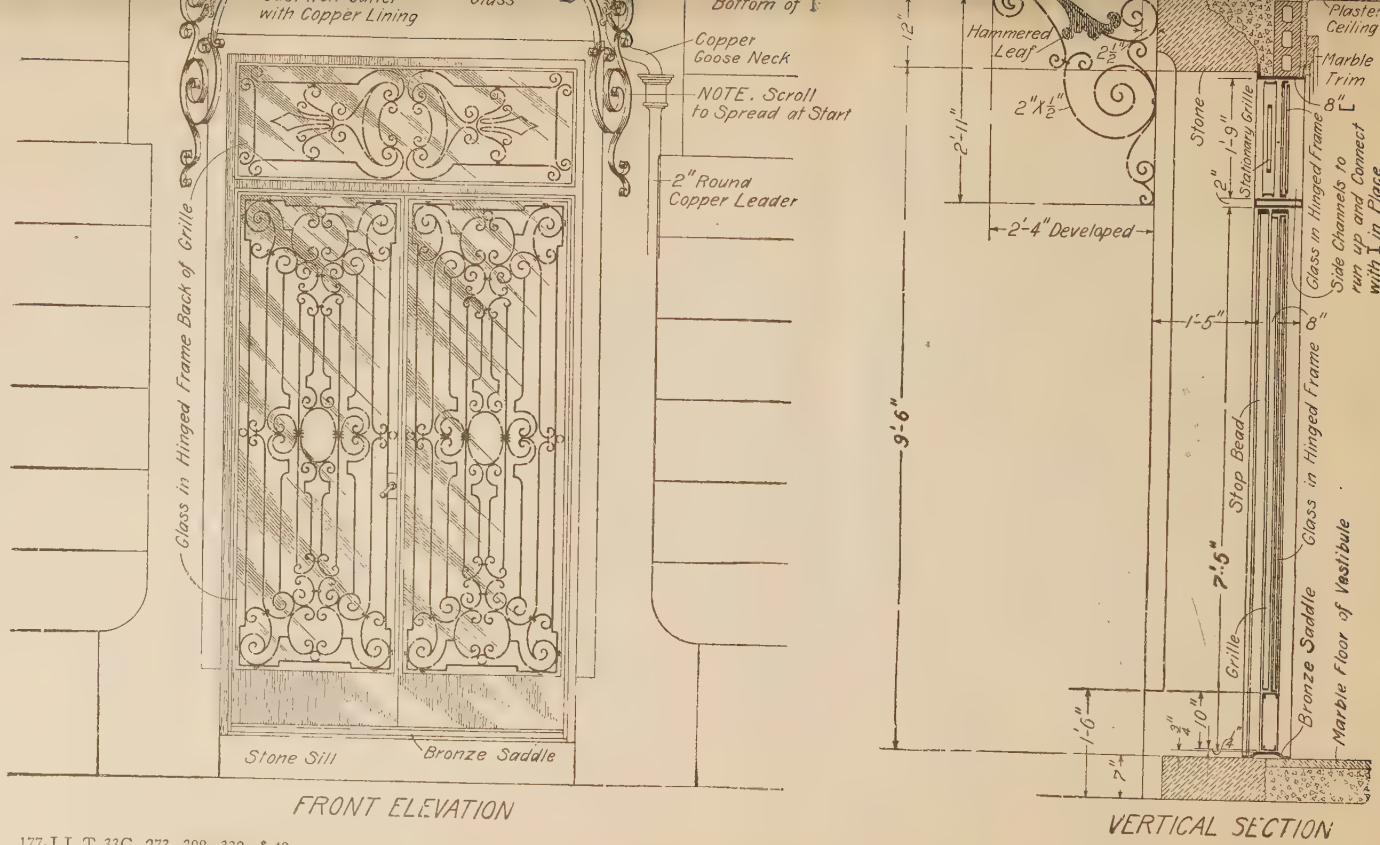

Vestibule
Plaster
Terra-Cotta Partition Blocks
Marble Trim
Glass in Hinged Frame
Grille
Stop Bead
Plaster
8" [Anchored in Stone
Brick
Window Gutter
Stone Facing
4" Channel Below
1/4" Glass
5'-0" Radius to Edge of Glass
3 1/3 Radius to Back of Channel
Ribs
Ribs are of 1/2" T's with Forged Ends
2'-6"
12"
3"
Glass
HALF PLAN OF ROOF
HALF PLAN OF DOOR


Copper
Glass
1 1/2" Tee
Rib Cut off
PLAN OF END


Marble Trim
Plinth
Plaster
1/2" X 1/4" Stop Bead
1/4" Glass
1" X 1/4" Grille
2 1/2" X 3/4"
2 1/2" X 1/2"
Blocks
Stone
SECTION OF JAMB


4" Channel with Cast Iron Rosettes
Glass


Window
Floor



177-I L T 33C, 273, 308, 332 § 48

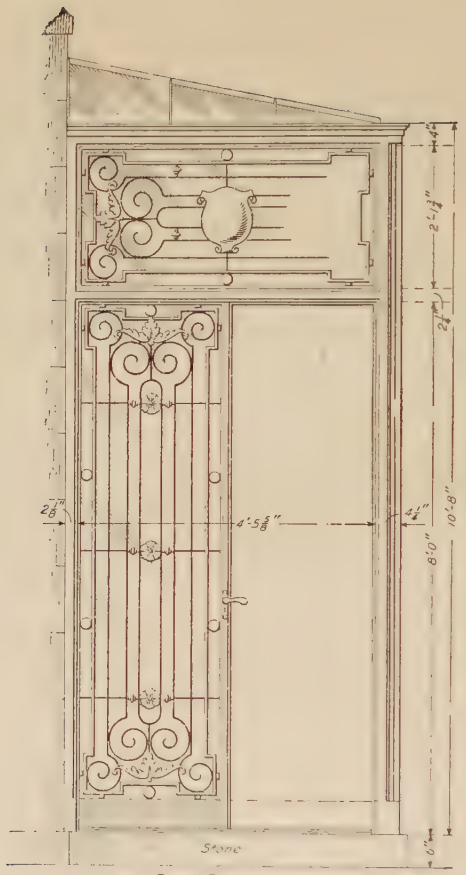
FIG. 82

An example of a fan design (this type is usually called a marquee) is given in Fig. 82 and it is only necessary to study the drawing in order to understand fully the construction. This style of canopy has rather a graceful effect over an entrance to a residence. As will be seen, it tilts back toward the wall, where the water is carried off by a copper gutter leading into a vertical pipe. The entrance doorway shown in the same drawing is similar to Fig. 84 and is built up in the same way.

54. Fig. 83 is a carriage porch and entranceway built of wrought iron. The supporting columns spread out toward the bottom, giving an impression of strength as well as lightness. Branching from the columns on each side of the porch are lanterns of appropriate design. The roof of ribbed glass is supported by trusses of graceful design, while it is also furnished along the sides and over the front of the peak with crestings and terminals. In addition to being an important part of the architectural scheme, this porch as a whole forms a protection from sun or rain.

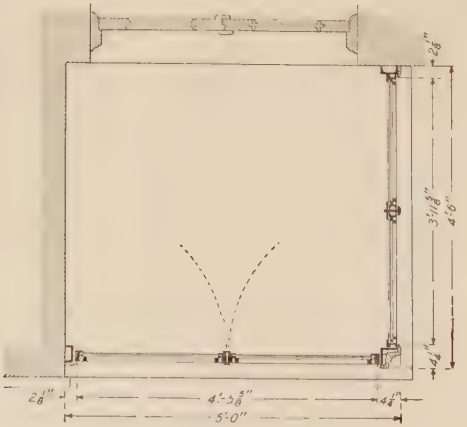
55. Somewhat similar to the porch just mentioned, but differing in that it is rather a vestibule, is the structure shown in Fig. 84 (*a*), (*b*), (*c*), (*d*). This vestibule is built in the angle of the building in front of the entrance. As far as the metal parts are concerned, it consists of the front, side, and roof, as can be seen from the plan in Fig. 84 (*b*). The detail sections in Fig. 84 (*c*) and Fig. 84 (*d*) show the construction of the enclosure.

The principal framing consists of 3-inch vertical channels placed next to the walls, a $3'' \times 3''$ angle at the corner, and an intermediate $2'' \times \frac{1}{2}''$ molded **T** bar in the middle of the side, dividing it into two panels corresponding to the design of the front. The bottom ends of these uprights are fastened to the stonework with expansion bolts or calked into holes in stonework. At the top, they are bolted to the cast iron cornice or gutter, the ends of the cornice being embedded and calked in the stonework of the building. All of the exterior lines of the gutter are of course horizontal,



Front Elevation

(a)



(b)

FIG. 84 (a), (b)

but the inner surface of the bottom should be made slightly inclined throughout its whole length back toward the wall of the house. This will allow rain water to run off to a point where it is conducted by a pipe to the ground, either on the outside or inside of the wall. If the gutter is lined with copper, as is sometimes done, the fall can be formed in the lining.

The doors and side are glazed with clear plate glass behind the grille-work, and in order that the glass may be accessi-

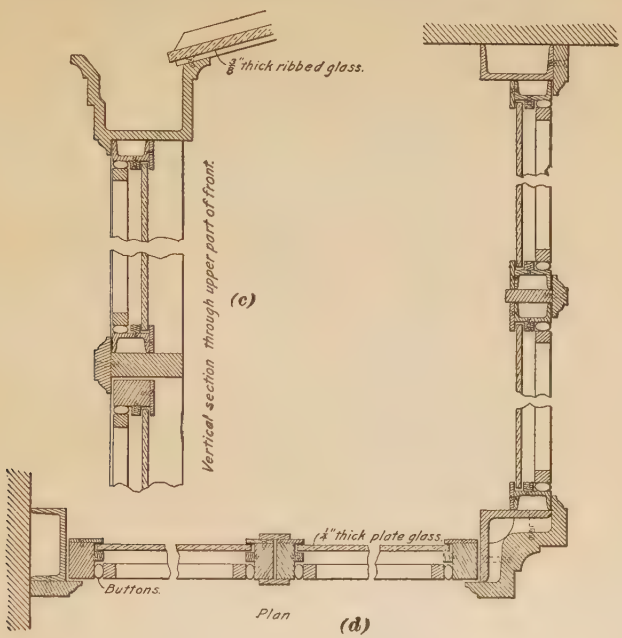


FIG. 84 (*c*), (*d*)

ble for cleaning, the grille panels are hinged. If it is preferred, the grilles may be fixed and the glass panels hinged. The frames of the doors are made of $1\frac{1}{2}'' \times \frac{7}{8}''$ and $1\frac{1}{2}'' \times \frac{3}{4}''$ flat bars, to which is screwed the square rabbets. The glass is placed against these rabbets and is held in position by the flat bar corresponding to what would ordinarily be the stop-bead. In case the glass becomes broken, this flat bar is easily unscrewed and the glass replaced. The bars and scrollwork are made of $\frac{5}{8}'' \times \frac{1}{2}''$ and $\frac{5}{8}'' \times \frac{3}{8}''$ material. The

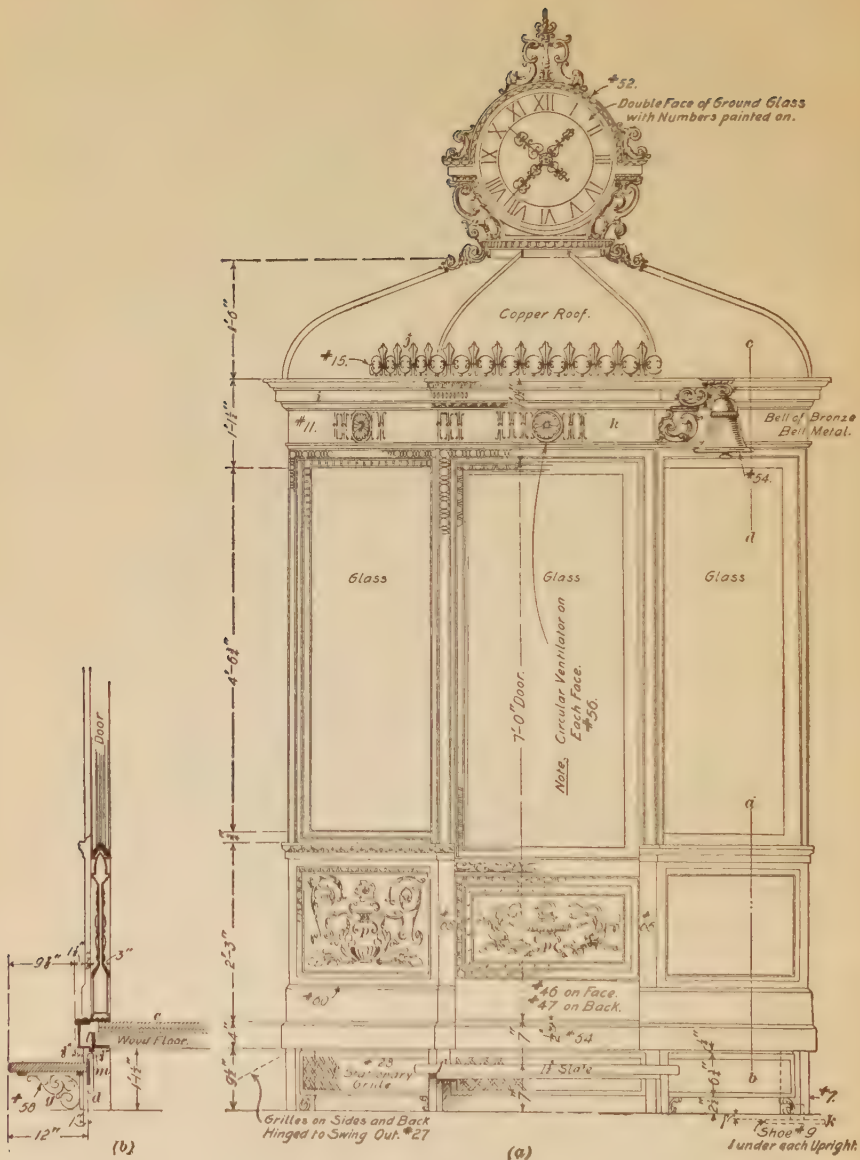

#52.
Double Face of Ground Glass with Numbers painted on.
Copper Roof.
#15.
#11.
Bell of Bronze Bell Metal.
#54.
Glass
Glass
Glass
Note. Circular Ventilator on Each Face. #56.
7'-0" Door.
#46 on Face.
#47 on Back.
#54
#28 Stationary Grille
11" Slate
Grilles on Sides and Back Hinged to Swing Out. #27
#9 Shoe under each Upright
1'-0"
1'-1½"
6'-6½"
2'-3"
9½"
Door
Wood Floor
9½"
1½"
3"
1½"
#50
12"
(b)
(a)

FIG. 85

side and transom panels are very similar to the doors, except that the frame, being stationary, is fitted close against the main bars, and is formed of channels instead of solid metal. The cast-iron moldings and trim are added to give finish to the structural parts. The roof is composed of $1\frac{1}{4}$-inch T's set about $1\frac{1}{2}$ feet apart and is glazed with ribbed glass $\frac{3}{8}$ inch thick, thus completing the structure.

The details of the pivots and lock for the doors are not shown. They should be drawn full size and arranged to suit conditions.

As a matter of practice, it would be well for the student to design a similar porch, changing the dimensions and sizes of material.

IRON STRUCTURES

56. It is sometimes desirable to erect small structures entirely of cast and wrought iron. Of these, the most common are the small domes or cupolas crowning the roofs of certain classes of buildings, and occasionally small detached buildings used as offices for the sale of tickets at the entrance of places of amusement, or as an adjunct to some branch of a general service system, as is the example hereafter shown. In any case, the structure is necessarily of an ornamental character, and must accord in design with surrounding conditions.

An example of a detached iron structure is shown in Fig. 85. The entire edifice is constructed of cast- and wrought-iron framework carrying a copper roof and heavy plate-glass window lights. The purpose of the building is that of a cab office in connection with the service of a hotel, club, or theater. The plan is octagonal, as shown in Fig. 86, each angle of the octagon being marked by a hollow cast-iron upright, molded to form the architraves of the window and door openings, and at the same time to contain the T-iron supports *d* of the roof and superstructure. These supports extend to the ground in each case, and stand on an iron plate, or shoe, as shown at *g* in the elevation, Fig. 85 (*a*), and between them is framed an angle iron, to

receive the ends of the floorbeams, as shown at *l* in the section, Fig. 85 (*b*). The space from this angle to the ground is filled with an iron grille, as shown in the elevation at *e*, while from the floor to the window level a cast-iron plate encloses each side of the octagon with an ornamental panel *p*.

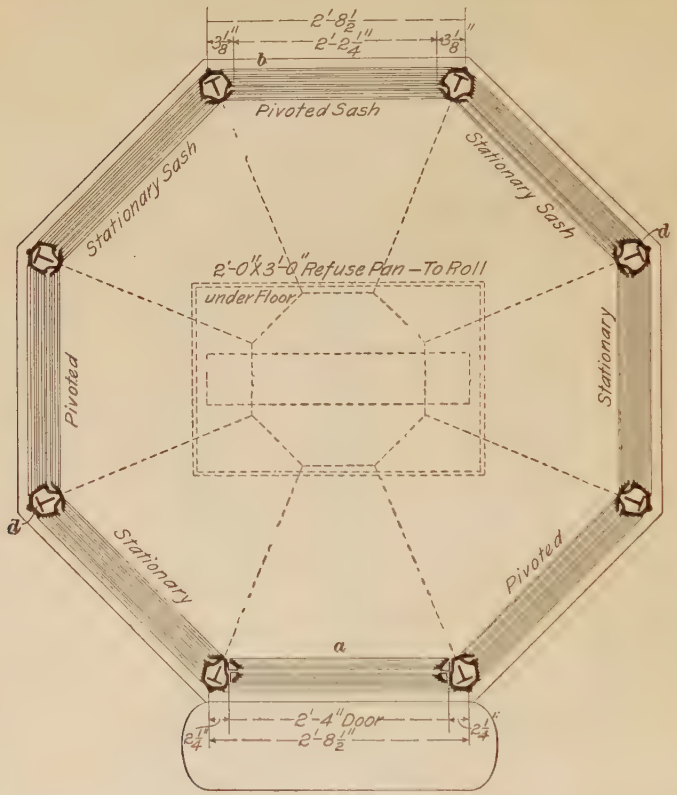


Fig. 86

The construction of this paneled dado can be better understood from Fig. 87, which is a section taken on the line *a b*, Fig. 85 (*a*). The angle iron framed between the vertical **T**'s, as shown at *l*, Fig. 85 (*b*), is here seen in section as piece #32, and outside of it is the cast-iron facing of the structure, consisting of a water-table 4 inches in height, and the plinth,

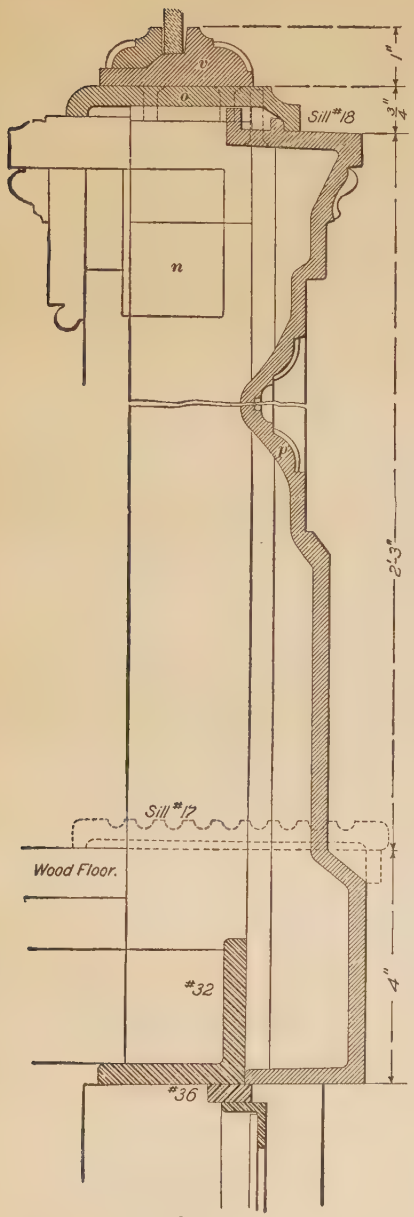


FIG. 87

panel, and window sill extending 2 feet 3 inches more. The sill cap *o* is secured at each end to angle-iron knees or brackets previously riveted or bolted to the vertical **T** supports. These sill caps extend over the top of the panel pieces and hold the latter in place by clamping over a rib piece cast on the top of the main panel, the panel pieces being fastened to the **T** supports by screw bolts. On this sill piece *o* rests the sash as shown at *v*, and on the inside of the office is secured the wood trim that forms the finish under the sill.

57. In Fig. 88 is shown a section through the cornice on the line *c d*, Fig. 85 (*a*). This cast-iron cornice is fastened at each end to the **T**-iron uprights with screw bolts, and thereby braces and secures these uprights at the top. The inside cornice *r* is secured in place by means of the wrought-iron strap *s* bolted to the main cornice, and to

which the inside cornice is fastened with screw bolts. Observe that these screw bolts do not pass through the sash head, but simply secure the two pieces of cast-iron cornice to the strap or bar *s*, as this sash is to be pivoted (see plan).

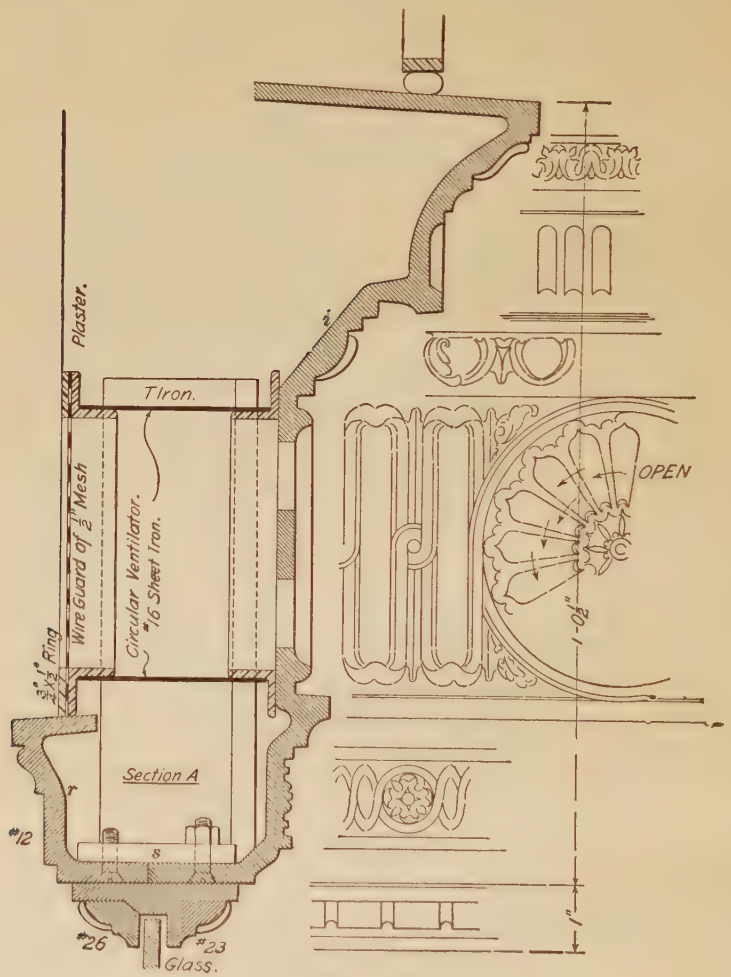
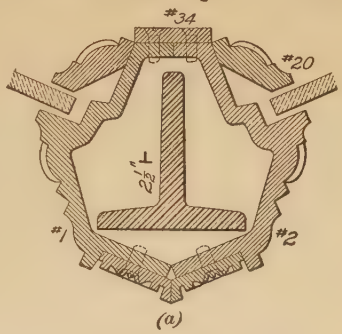
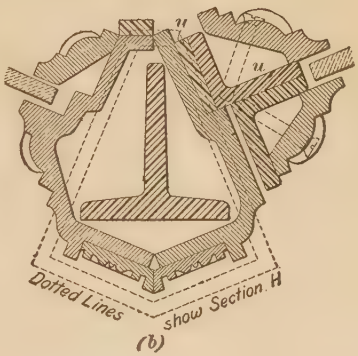


FIG. 88

In Fig. 89 (*b*) is shown a section through the lower part of the cornice where the sash is intended to be stationary (see

plan). The inside or lining strap *s*, Fig. 88, is omitted in this case, and the outside cornice secures the top of the sash with a round-headed screw bolt, while the inside cornice is fastened to the sash head by a countersunk screw bolt, the sash head serving the same purpose here as did the strap piece *s* in Fig. 88. At the door opening, the lower fillet of the inside cornice is omitted, thus permitting the outside cornice to fall below it and form a stop, for the top of the door, as shown in Fig. 89 (*a*). An inside strap





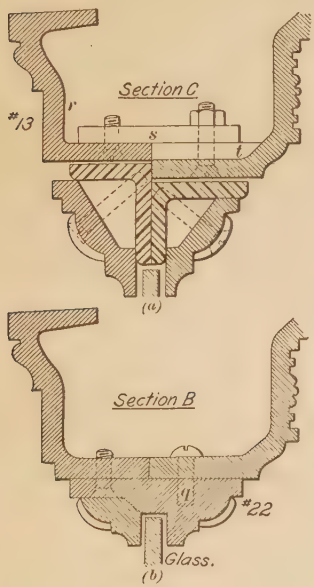


FIG. 89

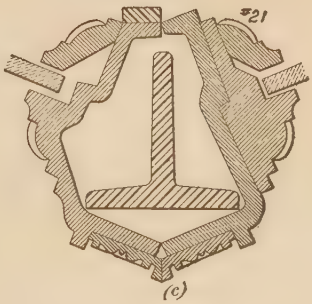


FIG. 90

or bar *s* is then used to screw these cornices to, for the preservation of their alinement, while the ribs *t* cast on the

exterior cornice maintain it in its proper position as a door stop.

58. The door frame is formed of two angle irons, whose legs are unequal, as shown in Fig. 89 (*a*). This inequality permits the inside angle to extend beyond the exterior one and strike (when the door is closed) against the door stop formed in the architrave or jamb casting.

Fig. 90 shows three sections through the architraves and supporting **T** irons of the main frame. At (*a*) is shown a section through the architraves of the fixed sashes, where the glass of the windows is held in place by a molding and recessions in the casting. At (*b*), the section shown is through the architrave at one side of the door, where provision is made in the casting for the door stop against which the longer-legged angle iron of the door frame shall strike; and at (*c*) is shown a section through the architrave at the side of a pivoted window sash. The glass is here shown secured in the cast-iron sash frame similar to that in Fig. 88, except that in this case a rabbet is cast in the frame and jamb against which the sash may strike when closed, and thus be prevented from revolving past the architrave.

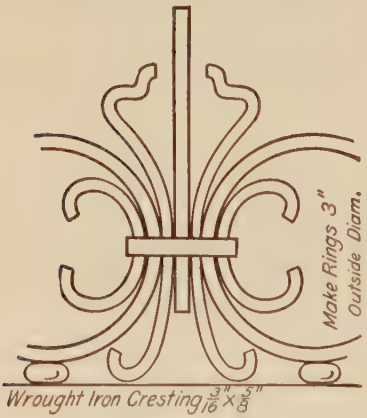


FIG. 91

59. The roof is framed with light angle irons bent to the form shown in the elevation, Fig. 85, and covered with copper on the outside, while the inside or ceiling is plastered on wire lath. The cresting around the eaves is of strap iron, the design being simple but neat, a detail of which is shown in Fig. 91. The clock face is framed in a cast-iron ring with ornamental scrolls as shown, the details being similar to other cast-iron ornament of this character heretofore described.

60. It is hardly necessary to reiterate that the more one knows of the characteristics of the material and the methods of manufacture, the easier it will be to originate appropriate designs. There are many very interesting and curious ways of solving the difficulties of molding and patternmaking that cannot be explained at length here. The explanations given cover the subject sufficiently for the present purpose.

CONTRACTS

BUILDING CONTRACTS

INTRODUCTION

1. Scope of Subject.—The parties to a building contract are usually the builder, the owner, and the architect, although in some cases the architect is not a party. Building contracts are nearly always between the owner and the builder, with the architect as advisor and arbitrator. In this Section, contracts will be explained and discussed in such a manner that a practical knowledge of the business relations that exist between the several parties to a building operation will be acquired, and the relative positions of these parties in the eyes of the law will be comprehended.

CHARACTER OF THE AGREEMENT

NATURE OF A CONTRACT

2. Definition.—A **contract** is a formal agreement between two parties for doing or not doing some definite thing. It is very clearly defined by Woolsey ("Introduction to International Law") as, "One of the highest acts of human free will, binding itself in regard to the future, and surrendering the right to change a certain expressed intention, so that it becomes morally and jurally a wrong to act otherwise; it is the act of two parties, in which each, or one of the two, conveys power over himself to the other, in the consideration of something done or to be done by the other."

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In the strictest sense, a contract is an agreement enforcible by law—an agreement based on sufficient consideration, and in such a form, and made under such circumstances, that a breach of it is good cause for action by law. It is this sense of validity before the law that distinguishes a contract from a simple agreement, the parties to which are not bound in such a formal way and are not amenable to one another for its fulfilment.

3. Parties to a Contract.—In the execution of every building operation of any size and importance, there are at least three persons interested—the *owner*, the *builder*, or *contractor*, and the *architect*. The owner is the person vitally interested, because it is his money that is being expended, and it is natural that he should want to receive the best material and workmanship consistent with the size and quality of the building to be erected and the amount of money to be expended. The builder, who is party to the contract, agrees to accomplish certain results for a stipulated amount of money, and in deciding the extent of his responsibility toward the owner, may be tempted to interpret the contract to best suit his own interests. The architect is employed by the owner as an expert adviser in matters of building, and is the judge that decides for the owner whether the builder is doing his duty and fulfilling his contract.

Though all men are deemed honest unless proved otherwise, it may readily be seen that a dishonest builder might, unless some valid agreement existed, make considerable trouble for the owner. The builder is even more at the mercy of a dishonest owner, for he might be led into a building operation that would require the expenditure of considerable time and money, and then, after the work is completed, he would be unable to collect the amount of his bill. This would more than likely put him to the additional expense of long and wearisome litigation, which, though the courts sustained his claim, might cause bankruptcy before he could recover it.

Even though each of the parties should be perfectly honest and inclined to deal fairly with each other, it is necessary to

have a contract that will stipulate the terms of the agreement in a perfectly clear and concise manner—drawn up, agreed to, and signed by each party concerned—so that each, over his own signature, will have defined for him his responsibilities and duties in the transaction.

4. Classes of Contracts.—Contracts may be divided into three classes: *written*, *oral* (or, as it is sometimes called, *parol*, or *verbal*), and *implied contracts*.

A **written contract** is one wherein the terms of the agreement are written or printed, and signed by the contracting parties.

An **oral,** or **verbal, contract** is one in which the parties concerned agree verbally (usually in the presence of witnesses) to transact or perform certain things.

An **implied contract** is one that is *understood* to exist, through the very nature of things, between two parties without any previous written or verbal agreement. For instance, one person employs another to perform a certain piece of work and thereby implies an obligation for reasonable remuneration to the person that performs the work; or a person accepts the benefits accruing from the performance of such work, and thereby implies an obligation to have satisfactorily performed the labor for which he was paid.

Most contracts embody at least two of the foregoing conditions, for the reason that it is almost impossible to fully cover all the terms of an agreement in a written or an oral contract, and much must be implied if a successful performance of the work is understood.

5. Written Contracts.—A written contract is usually regarded, though incorrectly, as more binding than either of the others. Its preference over the other forms lies in the fact that the statements of the agreement are in black and white, and, being signed by the parties concerned, cannot well be refuted; and since a certain amount of formality is required in order to draw up a written contract, the law regards the document as the finished and definite conclusion of all the preceding negotiations of the contracting parties and

as fully expressing the understanding between them in regard to the terms of the agreement.

That verbal agreements are regarded in such an unfavorable light by the law is probably due to the fact that witnesses and parties to a verbal agreement, as a rule, when called on in court to testify, utterly fail to agree in their statements as to what really was said on the specified occasion. The court is, therefore, inclined to accept and hold paramount any document that will explain, in any degree, the real understanding between the contracting parties. Hence it is, that even a note in the memorandum book of one of the parties concerned, or in a book of a third and disinterested party, as to the terms of the agreement, will be looked on with favor by the court, and will usually be held, should it prove to be genuine memoranda, as testimony of importance above that of a witness to the verbal transaction.

6. Oral Contracts.—It must not be thought that, in the absence of written documents, verbal contracts or agreements can be broken with impunity by either party, for such is not the case, as it is the custom of the courts in matters of this kind to endeavor to ascertain through witnesses and from circumstances the real understanding existing between the parties to such a contract, and to deal fairly with them, commensurate with the testimony and evidence given.

7. Implied Contracts.—Where the owner of a building stands by and sees certain improvements made, or labor performed, from which he will derive benefit, he implies a contract for the work, and is in duty bound to pay a commensurate price for the same, unless there is some stipulation to the contrary in a definite contract, or where there is some written document, previously made, that in some way nullifies this implied contract. For instance, the written contract may set forth that "No payments shall be made for extra work done by the contractor unless authorized, in writing, by the owner," or "by the architect." In this case, if the contractor does any extra work for which he has no written

order, he does it at his own risk, and would have no action against the owner in court.

In order to make clear the extent of an implied contract, the following illustration is of interest: A plumber was subcontractor to a builder during the erection of a house; the builder was subsequently discharged by the owner for drunkenness, but the plumber went on with his work, under the observation, and in some instances under the direct orders, of the owner. Having finished his work, the plumber looked to the owner for payment, which was refused on the ground that the builder had already been paid for the work. The plumber brought suit for the amount due him, and, though it was proved in court that the builder had been paid enough on the building to cover the plumber's claim, the court recommended that, if the evidence warranted it, the jury should oblige the owner to pay the plumber for at least such work as he had done subsequent to the builder's discharge. This view of the case was taken by the court on the ground that "Where one stands in silence and sees work done, or materials furnished for work done upon premises belonging to him, of which he accepts the benefit, a promise to pay the value thereof may properly be inferred."

8. **Competitions: Contract by Tender.**—Where designs or plans are submitted in compliance with the terms of a circular or printed notice, setting forth an invitation for such designs or plans and offering some inducement for same, it is regarded and has been declared by the courts to be a contract. In order that the validity of such a proposal be made certain, its terms should be set forth clearly and distinctly, and the person accepting the terms should comply with them strictly and to the letter. Proposals of this kind are advertised by committees or individuals, who call for competitive drawings of some public or private building. The submission of plans or designs in strict compliance with the terms of the advertisement constitutes a contract that is upheld by law, provided the advertisement is issued by persons of proper authority and responsibility.

Should a committee call for architectural designs that are to comply with certain conditions or requirements, and by subsequent notice modify these conditions to such an extent as to make worthless certain plans partially prepared by one of the competing architects, said architect would be able to recover the cost of such preparation. But if he had not commenced the designs until after the modified circular of advertisement had been issued, the later program would take precedence over the first and be held as embodying the terms of the contract.

Should the committee set forth conditions that would be impossible for an architect to fulfil in the design of any one building (such as a demand for certain accommodations that could not be provided for the stipulated sum of money), the architect should get the vote of the committee as to which requirement—cost or accommodation—takes precedence and which he is to disregard. The opinion of any one member of the committee is not sufficient, and only the joint decision of the entire committee should be accepted. Therefore, in issuing circular invitations for proposals or competitive drawings, great care should be taken to state in clear terms just what is wanted and required, and equal care should be exercised by any one complying with the terms, for not only has the law but little relief for persons that do not know how to express their ideas, but it also extends little hope to those that cannot understand a clear statement and misconstrue the intent of the published requirements.

THE CONTRACTING PARTIES

9. Formal Contracts.—A **formal contract** consists of a direct and pertinent proposal from the one party and an unconditional acceptance by the other. Such a contract may be made by a letter proposing certain terms, and duly accepted by a letter in reply, or the more usual form of a written agreement, setting forth in full the requirements of the one party and the unconditional acceptance of them by the other, and signed by both parties. In all formal contracts, the terms must embody every condition that is to be

complied with, and should be so explicitly stated as to be clearly understood by the contracting parties, so that there may be no misunderstanding between them in regard to the performance of the one party and the demands of, and consideration to be paid by, the other.

10. Contracting With Corporations.—An agreement entered into with a corporation differs very materially from one contracted with an individual. Almost any contract (provided it is not immoral) is binding on an individual, provided the intention is well defined and understood and a consideration is to be made for its fulfilment. Such, however, is not the case with a corporation. It behooves the person about to make a contract with a corporation to inquire into the scope of its charter, and to ascertain the limit of its powers to make such contract and the authority of its officers who are to negotiate the contract. In England, a contract requires the seal of the corporation in addition to the signatures of the proper officials in order to insure its validity, and such was formerly the case in the United States, though in many of the states the signatures of the proper officers are generally considered sufficient, provided they have the required authority through their charters and by-laws. In fact, courts in so many of the states have taken this view that it is more than likely, should similar cases arise in the other states, the courts would hold the same opinion. Irrespective of the matter of the seal, however, it is of vital importance in making a contract with a corporation to ascertain whether the persons representing the corporation are invested with the proper authority to make such a contract and that the corporation is bound to recognize it. There is no redress, and no action will be sustained, if the person entering into a contract with a corporation has, through his own neglect to obtain such information, entered into a contract with officials lacking the proper authority, and at variance with the charters and by-laws of the corporation.

11. Public Contracts.—In entering into a contract with a public body, even when the officials representing such

a body are duly authorized, it is imperative to make the contract with due formality, or it will not be legal. For instance, it has been held in several states that the county was not bound by a contract entered into by the county commissioners unless the commissioners were convened in a regular meeting of the board. A contract entered into informally, even within the legal authority of the officials, is insufficient.

When a contract is made with a public corporation for work to be performed under the supervision of a committee, such as a town committee, the contractor should ascertain whether the contract is made through the concurrence of a majority of the committee. Not only does this apply to an original contract, but also to any alterations to be made in one already entered into.

The contractor, in other ways, runs many more risks in dealing with corporations than he does with individuals, for a mechanic's lien is without effect against any public building, such as a schoolhouse, jail, court house, or town hall; and even aside from state, county, and town corporations, no such lien can be maintained against the property of a corporation operating for the accommodation of the public, such as railroad stations, ferry houses, etc.

Again, a public corporation is sometimes exempt from fulfilling its contract. An instance of this occurred in New York, when a contract was made for a public building. The erection, however, was postponed, and the contractors brought suit to force the fulfilment of the contract, but, though the contract was drawn with due formality and was perfectly legal, the court of appeals decided that a state could not be compelled by a contractor to erect a building, and that his only redress, provided the state broke the agreement and he himself was not in default, was a claim for damages, which must be made in the form of a petition to the state legislature.

12. False Representation.—Through lack of caution on his part, a contractor frequently finds that he has made

an agreement with persons that, though they have represented themselves as authorized to execute the contract, have no such legal authority. The corporation, therefore, refuses to pay the contractor his consideration, and he has no action against that body, though he may possibly recover damages from the persons that caused him to enter into the contract under false representations. It is, therefore, a good plan and a safeguard to both parties to have this matter clearly defined before the agreement is signed. It is, in fact, sometimes a matter of doubt whether the members of a committee who sign their names to a contract for building, to be paid for by a public corporation, do not sometimes, through the wording of the agreement or the manner of signing it, make themselves each personally liable for the amount of the contract.

13. The Lowest Bidder.—It is the common supposition that the award of a contract must be made to the lowest bidder, unless there is a statement in the tender for bids that stipulates that the parties making the tender "reserve the right to reject any or all bids." This is not the case, however, as no such stipulation is required, and the parties making the tender can omit such a clause without being bound to prefer the lowest bidder. The laws of some states and many public and private corporations require that bids shall be asked for all work involving an expenditure above a certain amount, and the proposal of the lowest bidder accepted. This being the case, the officials making the contract are bound to award it to the lowest bidder. When the stipulation is made in the tender calling for bids on certain work, that "the contract shall be awarded to the lowest responsible bidder," the discretion allowed the parties making the tender is so great in regard to what they may consider as constituting the "responsibility" of the bidder, that the law virtually admits that they may award the contract to whomsoever they may see fit, so long as they have decided truly in their own minds which party is the lowest *responsible* bidder.

The extent to which parties may be held in awarding a contract by the statement in the tender, that the award shall be made to the "lowest bidder," is well set forth in the confirmation of a decision by the Supreme Court of Pennsylvania. A case arose in Pittsburg, where the water committee awarded a contract for some mains to a party that was $5,000 higher than the lowest bidder. The lowest bidders having complied with all the terms of the tender and furnished the proper bond, felt that they were entitled to the contract, and applied for a mandamus in order to compel the committee to award the contract to them. The committee, in reply to the court's inquiry to ascertain if the mandamus should be granted, stated "that it was within their full knowledge and belief, that on a previous occasion the said firm had by some means or other attempted and did perpetrate a gross deceit and wrong on them, in surreptitiously departing from the specifications for a certain contract for the construction of boilers for the new waterworks, by striking therefrom, without the knowledge or consent of the said committee, the word *mud-drum;* also, that it was within the knowledge of some, if not all, of the members of the water committee, that the senior member of the firm was a man of intemperate habits, whose character for sobriety was not such as would warrant the committee in giving said firm a responsible contract; that the senior member also had attempted to bribe the mechanical engineer of the waterworks, who was the inspecting officer of said contract." They further stated that the firm was otherwise disqualified for the proper fulfilment of the requirements of the proposed contract. The report of the commissioner appointed in the case to take testimony showed that the said firm was the lowest bidder, and from a pecuniary standpoint was responsible; and while, in the opinion of the commissioner, the committee fully believed that the statements made were true, it was found that inquiry on the part of the committee would have shown that none of the three accusations made, as to attempted deceit, intemperance on the part of the senior member, and bribery of the engineer, was substantiated. Notwithstanding

this, the court held that the committee's action could not be changed.

The Supreme Court, in the confirmation of the lower court's decision, said: "The learned judge who, as the mouthpiece of the court to which this case was submitted, delivers the opinion, finds that the facts stated in the petition are true, and that the allegations contained in the answer, as above set forth, are wholly without foundation, but that, notwithstanding this, the committee fully believed that what was asserted in the answer was true. We must take this opinion of the court as to the belief of the respondents to be correct; nevertheless, it does somewhat surprise us, that this body of men, intrusted with so important a duty, should have rested so contentedly under a delusion which a little inquiry in the right direction would have dissipated, and thus save a handsome sum of money to the city treasury." In regard to the word *responsible* the court held that it means something more than pecuniary ability, and further stating the case said, "In a contract such as the one in controversy, the work must be promptly, faithfully, and well done; it must, or ought to be, conscientious work; to do such work requires prompt, skilful, and conscientious men. A dishonest contractor may impose work upon the city in spite of the utmost caution of the superintending engineer, apparently good, and even capable of bearing its duty for a time, which in the end may prove to be a total failure, and worse than useless. Granted that from such a contractor pecuniary damages may be recovered by an action at law, this at best is but a last resort, that often produces more vexation than profit—a mere patch upon a bad job—an exceedingly meager compensation, at best, for the delay and incalculable damage resulting from the want of a competent supply of water. The city requires honest work, not lawsuits. Were we to accept the interpretation insisted upon by the relators, the difference of a single dollar, in a bid for the most important contract, might determine the question in favor of some unskilful rogue, as against an upright and skilful mechanic. Again we know that, as a

rule, cheap work and cheap workmen are but convertible terms for poor work and poor workmen, and if the city, for the mere sake of cheapness, must put up with this, it is indeed a most unfortunate position. It is settled beyond controversy, that where the complaint is against a person or body that has a discretionary or deliberate function to exercise, and that person or body has exercised that function, according to the best of his or its judgment, the writ of mandamus will not be granted to compel the undoing of what has been done."

Bidders for public work under the statute that work shall be given to the lowest bidder, must comply strictly with the terms of the tender if they expect their proposal to be accepted or even considered as the lowest bid.

THE SIGNATURE

14. What a Signature Implies.—Since a contract is a mutual agreement between two or more parties, it becomes essential to its legality that there should be available proof of the fact that the contracting parties thoroughly understand it in the same way and willingly assent to the obligations incurred by the conditions—in other words, that the parties are of one mind. Therefore, when the signatures of all the contracting parties are affixed to the document setting forth the terms of the contract, they are deemed by law as evidence of this mutual agreement and understanding, and impart validity to the document.

A signature may be the inscribed name by which a party is known; or in case he cannot write, his mark, or cross, will be regarded as legal, provided it is witnessed and his name is written near it in the customary way and by a duly authorized party. It has been held, however, that a signature "by mark" is *not* valid if made by the other party to the contract for the one signing the contract by mark.

There are cases where it is not necessary that a person should sign a contract in order to be bound by its conditions. For instance, a person is mentioned in a contract as one of

the signers, and he is also to act as an attorney for another party to the same contract. If he signs only as attorney for the other person and does not sign on his own account, he is nevertheless a party to its fulfilment, the same as though he had signed it in his own name. It has been held in court, that since he must have read the document before signing it as attorney, and must have seen that he was personally mentioned as one of the signers, by failing to make any remonstrance against it and by accepting its benefits, he assented to its terms and became a party to its fulfilment, the same as though he had signed it in his own name. It is reasonable, therefore, to suppose that any person knowing the terms of a contract and being aware that he is personally interested in it who stands by without resistance or remonstrance and sees it drawn up and afterwards accepts the benefits recurring from such agreement, will be held responsible by law and will have no excuse on the ground that his actual signature is not on it.

If the signature of a person appears on a contract as a party to that contract, the law assumes that the signer is able to read and is familiar with the contents of the document. It is not necessary in the first instance to prove that the contract was willingly signed, that an opportunity was afforded to read the document, and that no means were used to prevent the signer from reading it. Such proof is necessary only if there is allegation to the contrary.

If a party to a contract is unable to read or write, and his signature to the document is made by mark, there must be a subscribing witness, and then the law assumes that the contents of the contract were made known to him, and will not excuse him from its obligations unless he can prove that its contents were not read or explained to him or that he signed under compulsion.

Where the contract is in a language not understood by him, the signer occupies the same position with regard to the law, as just stated, where he cannot read or write. If the question arises, it must be proved that the contract was translated to the signer with sufficient clearness to give him a fair

understanding of its terms, and that no deception was practiced or misrepresentations made.

Therefore, before signing, the party about to affix his signature should read the contract over carefully, in all its parts; not only should he read any printed matters that may be embodied in it, but he should consider carefully any script that may be interlined between the printed substances, as writing is held by the courts to take preference over printed statements, and where there is any inconsistency existing between the two, the written portion controls, as more attention is usually paid by the contracting parties to the written matter. No party, however, is excusable on the plea that he did not read the printed form. Such a case was tried in the District of Columbia. The party, on having the written part of an agreement read to him, ordered his signature to be placed on the instrument, without reading or having read to him the printed substance of the agreement. As it was proved that he could read, and had an opportunity to do so, it was held by the court that he was responsible for the agreement in the terms and to the purport of the entire document.

15. Unsigned Agreements.—A contract signed by one party and then delivered to the other is binding on the one who signs the agreement, whether the other party signs it or not. Such a case was decided in the Supreme Court of New York. A party receiving an unsigned agreement by messenger affixed his signature, and on handing it to the messenger remarked that he would not be bound by it unless certain things were done. He afterwards wrote to the other party to the agreement that he refused to be bound by it, and withdrew. The court held, notwithstanding the fact that it was not signed by the other party, that the party who had signed it was bound, and that parol evidence of conditions qualifying the delivery was not admissible.

THE CONSIDERATION

16. Compensation.—Every agreement, unless under seal, must have some specified consideration, or payment for services rendered, stipulated in its terms in order to make it valid; for, although a contract may be properly executed and signed in the presence of witnesses, yet, if there is no consideration mentioned—that is, no remuneration to the party for performing labor or for furnishing material—the contract will not be legal and cannot be enforced in law. The remuneration may be money, labor, or materials, but there must be some statement to show that neither party is furnishing goods nor working without recompense from the other. In cases involving the enforcement of a contract, an effort is often made to prove that the entire agreement, or a portion of it, or some supplementary agreement, was without promise of consideration or remuneration and therefore of no force; and if the court takes this view of the matter, the contract cannot be enforced.

This is such an important item in assuring the validity of a contract or agreement that it is wise to commence every agreement, even if involving only a small amount, in somewhat the following manner:

"*For the consideration hereafter to be mentioned*_____ *A*_____ *promises and agrees to deliver certain goods* (*or do certain work*) *for*_____ *B*_____." The consideration should then be specified in detail elsewhere in the agreement.

The amount of the consideration matters little, for if a man is so unwise as to agree to build a house for a party in consideration of the sum of $1, the court will hold him to his contract, though he might be ever so much inclined to withdraw from such an unprofitable agreement.

17. Sealed Contracts.—Sealed contracts constitute an exception to the foregoing rule; for, in the language of the law, a seal "imports a consideration." Therefore, a seal placed in a legal manner after each signature on a contract will take the place of the stipulated consideration and make

binding all the promises contained in the contract, admitting no opportunity on either side to renounce these promises, or any part of them, even where no consideration is mentioned.

Formerly, the seal consisted of a drop of sealing wax, on which there was impressed the peculiar signature of the party concerned; or, in some cases, merely the end of his thumb was applied to the soft wax, and its imprint acted as a signet. In these days, however, the private seal is usually a piece of red paper affixed to the document with mucilage, and even this formality is not required in some states, which consider a blot of ink an adequate seal.

It can therefore be readily seen that it is always best to have the signatures to a contract under seal, as in this case there would be no possible opportunity for dispute in regard to the consideration by the parties, as in affixing their seals to the agreement they mutually consent to its terms, irrespective of a consideration.

18. Entire and Divisible Contracts.—All contracts may be divided in two classes, *entire* and *divisible*. **Entire contracts** are those that provide that a certain complete performance shall be paid for on its entire accomplishment, while a **divisible contract** is one that is complete in its several parts, the proportionate cost being paid in several instalments. In the entire agreement, the party performing the contract is not entitled to payment until it is completed, while in the divisible contract he may collect part payment at the completion of each stipulated part. A good example of a divisible contract is one that provides for the building of twenty houses at so much for each house. In this case, the contractor would be entitled to receive payment for any number he had finished, whether the entire twenty were completed or only one. A contract, therefore, that consists of an agreement by one party to perform certain work, complete in itself, and of an obligation by a second party to pay so much for the work, will not allow the first party to collect any portion of the entire consideration before the work is

completed; and, should he fail to complete his portion of the contract, he would be unable to collect *anything* for work done or material furnished, provided his failure to accomplish it was not due to any interference by the second party or by law or by the "act of God." If, however, the agreement should stipulate that payments be made at stated periods, as the work reached certain designated stages, a court may decide that owing to the terms of the agreement the contract becomes a divisible one, and that the builder or contractor can claim payment for such portion as may be completed, even should he fail to carry on the work to completion; but in all probability the courts of the different states would decide differently on this question of divisibility of contract, as it is frequently a difficult one to settle. As a building contract is divided more or less into a number of separate clauses and stipulations, relating to separate parts of the building, quality of material, workmanship, etc., it might be held in some courts that it is a divisible contract and that the contractor has a right to recover for labor performed and material furnished, on a portion of the contract.

THE ACCEPTANCE

19 Accepting a Contract.—Much uncertainty exists as to how soon a proposal should be accepted, and the courts have spent much time on cases involving this question. In one case, a person wrote to another offering employment and requesting a prompt reply. The offer was accepted by the person to whom it was made on the day following its receipt, and the letter of acceptance was handed to a boy to mail. The boy neglected to mail it until 2 days later. In the meantime, the person offering the employment had secured some one else to fill the place. In the suit that followed to compel the employer to keep to his proposal, it was held by the court that the time that elapsed between the offer and the acceptance was too long, and the proposal did not hold.

In the state of New Jersey, it has been held that where the offer specifies that it is open until a certain date, an

acceptance on that date is binding, unless the offer has been withdrawn previous to the acceptance.

Where the acceptance is made by letter, the question frequently arises as to whether it may be considered as taking place, and consequently the contract closed, at the time it is mailed by the party making it or not until it is received by the proposer. English law considers the acceptance made and the contract closed from the moment the letter of acceptance is delivered into the hands of the messenger that is to take it to the party making the proposal. This view seems to be held also in the states of New York, New Jersey, New Hampshire, Illinois, and Mississippi, but may be held differently in other states. The courts of Massachusetts, as well as the federal courts, hold that the contract is not binding until the acceptance is received by the party making the proposal. The posting of a letter of acceptance is usually considered as equivalent to its delivery to a messenger and binds the contract, even though it is not received by the other party. There are, however, exceptions to this, for, in one case where there was no proof that the postage had been paid, the New York Supreme Court decided that the acceptance was not complete. It should be remembered that the courts, in dealing with such uncertain questions as the foregoing, are usually governed by circumstances and the intention of the parties concerned rather than by abstract law principles and rulings.

The decisions of the courts in regard to telegraphic acceptances are quite varied, and, strange to say, are in some cases in opposition to their decisions in regard to acceptance by letter. The federal courts have held that an acceptance by telegram is binding the moment it is placed in the hands of a telegraph company for transmission; while, in acceptances by letter, as previously stated, they hold that it is not binding until received by the proposing party. Again, the New York courts hold that an acceptance by telegram is not binding until it is received, while, in regard to letter acceptances, they have decided in the same state that the acceptance is binding at the time it is posted.

20. Extent of Obligation.—All courts hold that bids must be accepted or rejected unconditionally. If a person in accepting a bid bases his acceptance on any conditions differing from, or contingent on, some change of the original proposal, the bidder is not bound by it, and may refuse to sign the contract; and, even should he remain silent, thus apparently accepting the bid, he cannot be held to it; and though the party made a subsequent unconditional acceptance, the contract would not be binding. Such conditional acceptances are of common occurrence among architects and others, who, on receiving bids for the performance of work, will write to the favored bidder that his proposal is accepted, on the condition that he will sign a satisfactory contract. Such an acceptance is not binding, and the bidder could withdraw his proposal if he saw fit and could not be held responsible.

In the acceptance of a proposal, the price named is often found to be a little less than the price asked by the contractor for doing the work; whether this is unintentional or whether it is a trick of unscrupulous parties, the fact remains that an acceptance in this way is not only in no way binding on the contractor, but actually releases him from his original offer. The assumption of the courts in regard to acceptances or proposals is clearly expressed by an Illinois court as follows: "A proposal to accept an offer on terms varying from those proposed amounts to a rejection of the offer, and a substitution in its place of a counter proposition, which cannot become a contract until consented to by the first proposer. The original offer thereby loses its validity, and is no longer pending between the parties, and it becomes an open proposition again only when renewed by the party who first made it; hence, the party who submitted the counter proposition cannot, without the consent of the other, withdraw or abandon the same, and then accept the original offer, which he had once virtually rejected."

21. General Conditions.—The architect usually prefaces the detailed specifications with matter covering all the

general conditions that are to be complied with by the contractor. (See *Specification Writing*.) This portion of the specification includes all general stipulations concerning terms of payments, time of completion, compliance with building ordinances, the obtaining of permits for water, blocking street and sidewalk, etc., together with other stipulations of minor importance. The contractor in bidding on the work accepts all the specifications, including the general-condition clauses, and on the acceptance of his proposal, he becomes bound in contract to all the terms of the specifications.

It is sometimes advantageous for an owner to accept unconditionally and promptly an especially favorable bid without the risk of a conditional acceptance, which would give the contractor a chance to withdraw. The owner in such a case runs no risk if proper general conditions have been embodied in the specifications, as a contract thus made is perfectly valid, and the builder in subsequently signing a formal contract that contains additional stipulations regarding insurance, time of payment, etc., usually does so with advantage to himself. Should the specifications not embody adequate general conditions, however, and the bid be accepted unconditionally, such a contract is equally valid, but the contractor can be held only for such stipulations as are mentioned in the specification. If the time of completion is omitted, the court will decide that a reasonable time is understood, though the legal idea of "a reasonable time" is likely to be at variance with that of the owner, much to the latter's dissatisfaction. Other terms of still greater importance may be found to have been omitted from the insufficient general conditions in the specifications, which will cause the owner much trouble and annoyance.

22. **The Position of the Architect.**—The architect sometimes oversteps his authority by accepting a proposal without duly consulting and being authorized by the owner. The extent of the architect's power in this direction, where the specification does not make exact and specific statements in regard to it, has not yet been determined by law, and the

zealous architect that accepts a bid in behalf of his client without consulting him or obtaining his indorsement to same is likely to be placed in an awkward position should the owner refuse to accept the proposition.

Therefore, if the owner is desirous that the architect should be empowered to accept immediately, at the time at which it is made, any proposal that would be to the owner's interest, he should authorize him in writing to do so, either giving him full power or limiting him to such an extent as he may see fit. Probably the safest and most satisfactory way of taking care of this matter is for the architect and owner to draw up an agreement by which the architect is empowered to accept or reject proposals, but only when such letters of acceptance or rejection are indorsed in writing by the owner. In such case, the general conditions of the specification should also state that the ordering of extras and the acceptance or rejection of proposals are to be in writing, either by the owner or by the architect, with the written indorsement of the owner.

The authority of the architect to accept bids and proposals is of vital importance to the contractor, who is liable to discover, too late, that he has made his contract through a person unauthorized by the owner. Therefore, in all cases where the slightest doubt exists, the contractor should ascertain *at once* that it is the owner's intention that the architect should be so empowered and that the architect's acceptance will have the owner's subsequent approval. In accepting a bid for the owner, the architect should exercise due caution in the wording of the acceptance, so that he may not himself become involved in its obligations, and his letter should plainly show that he is acting solely as agent for the owner by stating that "Being duly authorized by Mr. A. B. (owner), I hereby accept in his behalf your proposal"; or, "Through the instructions of Mr. A. B. (owner), I am authorized to accept for him your offer," accompanying the letter with the written authorization of the owner. Some specifications call for the ordering of extra work and the acceptance or rejection of bids by the owner only.

23. Withdrawing or Modifying a Proposal.—Although somewhat a matter of doubt, the general rule in regard to the withdrawal or the modification of a proposal is, that until accepted the proposal remains a proposal only, and may, up to the time of its acceptance, be withdrawn or modified. In the case of a proposal sent by letter, there is no doubt that the offer is open until the letter is received, and if the person making the offer can telegraph his withdrawal so that it will reach the proper person before the original proposal, the offer is nullified, and the parties interested in it are in the same relation as they were before the offer was made. But it has been held that if a person *receives* a proposal and immediately sends an answer accepting it, the offer stands valid, even though the party making the offer has despatched another letter in the attempt to withdraw it.

24. Delivering a Contract.—The formality with which the contract is delivered is of little importance, for if it is left at the place of business of the party concerned, the delivery is deemed complete, unless otherwise stated in the contract itself. A court in Illinois has held that one copy of a contract between the owner and the builder, being left in the care of the architect, had, to all intent and purpose, been delivered, and was binding on both parties.

Where several copies of a contract exist that are supposed to be alike in their terms and statements, but that as a matter of fact differ one from another, either party complying with the terms of the agreement in his possession is responsible only for the terms of his own copy.

MODIFICATION OF CONTRACT

25. Modifying Contracts.—Though formal contracts are generally made with due consideration and carefulness, and are looked on by the law as binding and enforcible on both parties, still it is human nature to be fickle and changeable in mind, and unforeseen events may transpire that will change the aspect of affairs entirely; hence, it becomes necessary to provide that an agreement may be

changed or modified in some manner, if so desired by both parties. This result may be accomplished either by *agreement* or by *waiver*. Where modifications in a contract are desired, such changes may be made by a mutual agreement between the contracting parties. This amendment, or modifying agreement, whether made at the time at which the formal contract is drawn up or later, has equal force with the original contract and is considered together with it. Many courts have held that such an agreement is valid, even when verbally made, unless there is a stipulation in the more formal agreement that no change or modification shall be made in the original contract unless in writing.

However, where the contract to be modified is with a corporation (especially if a public corporation), caution must be observed to see that all such changes and modifications are made with due formality; unless this is done, the contractor may have cause to regret his carelessness.

26. Sealed Contracts.—Since a contract under seal is regarded by the courts to be a more formidable instrument than a simple contract, owing to the formality with which it is executed, most courts are more severe in regard to any change or modification in a sealed contract, as shown by the following opinion of the court: "While a simple contract reduced to writing may be varied or changed in any way by a subsequent verbal agreement, it is otherwise as to contracts under seal, which cannot be varied by a mere parol contract, whether in writing or not, since such a contract is inferior to the original." Hence, as nearly all formal contracts, whether of corporations or individuals, are under seal, it is evident that great caution should be used, and that no attempt should be made to modify any such contract otherwise than in writing and with all the formality that attended the execution of the original document. Courts have held that "a sealed contract cannot be rescinded or released by a parol agreement." It is admissible, however, according to a decision given in the state of Illinois, to subsequently agree verbally to pay an additional price for the

same work as is stipulated in the written agreement, which agreement will remain valid in all particulars, except as to the price mentioned in the original document.

A contract that is not under seal may sometimes be changed or modified by an *implied agreement;* that is, should a man by his actions declare certain intentions, which vary from the original contract, and should these intentions be accepted by the other party, also provided there was no stipulation in the contract that required "that all changes from the original agreement should be made in writing," a court may hold that the implied agreement to change the original contract was the mind and intention of both parties and was therefore binding. Even when there is a clause in the original contract excluding any change by verbal or implied agreements, the court will, under some circumstances, uphold such changes, provided the intention of both parties can be proved beyond doubt to have been agreeable to such a change.

27. Liability of Owner.—That "silence gives consent" does not always hold good in law; in fact, very frequently the opposite is true, and such a view is usually taken by the courts in cases where it is held that the contract or portions of it have been waived by implication. If an owner should observe, in silence, deviations from the contract, it does not necessarily follow that he must accept or pay for such changes. In the first place, he may not be an expert in building matters, and again he may not fully realize the importance of such changes, though, if it could be proved that he favored such changes and assented to them, knowing that there would be additional cost attached thereto, the chances are that the court would hold him responsible. In regard to this, a Pennsylvania court held that "it is no excuse for non-performance, that the employer looked on while the work was in progress, unless there be evidence from which his assent may be implied."

28. Invalidation.—Many contractors are of the erroneous opinion that where there have been a number of changes

and modifications from the original contract, that such changes and modifications invalidate it, and they are privileged to ignore the original agreement in regard to price and may demand day-rate wages for the work. Such, however, is not the case, and all courts of justice will endeavor to obtain evidence to show what portions of the original contract remain intact and have not been mutually waived, and will enforce those portions accordingly. Where it is impossible, owing to the complications arising from numerous waivers and changes, to ascertain the terms of the original agreement, and in what relation they exist in regard to the actual work done, the court will endeavor to ascertain the reasonable cost of the work and material and award the contractor his claim on that basis, holding that, "when the original plans, on which the contract was founded, have, by mutual consent, been so substantially and materially departed from as to amount to a constructive abandonment of its terms and specifications, the case should be regarded as one of general employment, with an implied obligation by the owner to pay what the work and material are reasonably worth."

CARRYING OUT THE AGREEMENT

DEPARTURE FROM THE CONTRACT

29. Substantial Fulfilment.—Departure from a contract may be through either carelessness or wilfulness. The decision that a New York court has rendered in regard to such departure is well stated in a report as follows: "Parties to building contracts should be exact in the fulfilment of their agreements, even to the smallest particulars; and if they wilfully or carelessly depart from any one of them, they should incur the penalty, however severe it may be. But if a party, while acting in good faith, and with a determination to do all that he has contracted to do, unintentionally, and without any negligence, happens in some trifling matter to vary or depart from the terms of the contract, the law is not so severe and exacting as to deprive him of all compensation;

it ever regards the substantial rights of the parties, but overlooks trivial and unimportant matters."

To just what extent the court will hold a person for such deviations from a contract is somewhat undeterminable. It is, however, a foregone conclusion that the party will be held to the substantial fulfilment of his contract, the court deciding just what is meant by "substantial fulfilment."

The following case will show the position that the court took in regard to an unavoidable deviation in a contract for a block of stores. During the erection of the stores, the contractors discovered that the city had given them the wrong grade for the sidewalk, thus raising the stores about 8 inches too high. They notified the architect and a representative of the owner, who made no objection at the time. A balance on the payment due on the final certificate given by the architect was refused because of the mistake in the setting of the building. The case was carried to the Supreme Court, which decided in favor of the contractors as follows: "As there has been no wilful departure from the terms of a building contract, nor any omission in essential parts, and the laborer has honestly and faithfully performed the contract in all its material and essential features, he will not be held to have forfeited his right to remuneration by reasons of mere technical, inadvertent, and unimportant omissions or defects. * * * A substantial compliance with the contract is all that is required to entitle the builder to his reward."

30. Determining the Responsibility.—Deviations from the agreement due to the contractor's non-compliance with the specifications or drawing are often held to be the direct cause of poor or insufficient construction, resulting in damage to the building and loss to the owner. Where such is the case, it often becomes the court's duty to fix the responsibility, which, should the damage prove to have been due to the deviations from the contract, will very likely be placed on the contractor, even though there were no objections to them by the owner.

The following is an illustration of such a case: A contractor bound by an agreement, supplemented by plans and specifications, erected, or partly erected, a frame church; it was nearly completed when a severe gale blew it down. Subsequently, the contractor entered suit for the money due him; the owner held that certain deviations were made from the contract that were undoubtedly the cause of the damage, but he had, however, made no previous objections to the changes. The architect brought evidence to prove that the manner of construction in question, and from which the deviations had been made, was shown on the drawings, though there was no mention of it in the specifications. The evidence of the witnesses was rather unsatisfactory, as they differed in regard to the relative merits of the two constructions, also in their interpretation of the plans. The jury was instructed by the judge as follows: "If the contractors departed slightly from the plans, specifications, and drawings, and yet if such a departure did not diminish the strength of the building, nor contribute to its being blown down, such departure does not deprive them of their right to recover in this action, as the contract appears by the evidence to have been otherwise complied with." The decision was reversed, however, by the Supreme Court of Illinois, which said: "This position is untenable. The contractors had no right to depart from the working plans made part of the contract. If they did so, it was at their peril, and they would become guarantors as to the strength and safety of the structure. * * * The drawings were made part of the agreement. The contractors could only discharge themselves from liability by constructing the building in accordance therewith, unless a deviation was mutually agreed upon."

ABANDONMENT OF CONTRACT

31. Reasons for Abandonment.—The abandonment of a contract occurs through the neglect of one or both of the parties to carry on the work for which they contracted. It may occur through the builder being unable to carry on the work or the owner refusing to longer be a party to the

agreement; or it may be that the interference of the law or some irresistible power prevented the fulfilment of the agreement. In any case, where the terms of the contract are well defined and have not been mystified by many changes and modifications, the court will endeavor to enforce them or such ones as may still be binding.

Should the work, when partly completed, be abandoned by the contractor without cause or without the consent of the owner, and should the builder refuse to proceed with it, the courts will not allow him a claim. He would not only be unable to recover a reasonable price for the completed work, but would be liable to the owner for damages.

If, however, the owner accepted the abandoned work and derived benefit therefrom by proceeding to complete the agreement under another contractor, the courts would be likely to hold that, on the completion of the work and the final payment to the second contractor, the first contractor would be able to recover the balance, if any, existing between cost of the work as done under the second contract and the amount of the original contract, deducting, of course, any damages that the owner might have sustained by delays caused by the abandonment of the work.

32. Responsibility of Owner.—The owner instead of the contractor is often at fault in carrying out the agreement, and in such a case the builder usually has no cause to complain of his treatment by the law. Where the owner is delinquent in the fulfilment of his agreement, the contractor may present his case to the court in two ways: (1) He may hold that the contract is still in force and claim compensation at the contract rates for the work that has been done together with a claim for damages that resulted to him, due to loss of profit on account of the owner's delinquency; or (2) he may claim that the contract has been abrogated, or annulled, and require reasonable payment for his work and materials furnished. Though he has either of these paths to pursue in prosecuting his case, the law clearly states that he cannot present evidence applicable to both, but must

accept one or the other and hold to it. He should be governed as to his choice by the circumstances surrounding his claim and the advice of his counsel.

In regard to a case where a contractor was prevented by the owner from proceeding with the contract, the New York Court of Appeals plainly stated the two grounds upon either of which a contractor could take his stand in presenting his claim. The opinion that was held by this court is as follows: "Where performance is prevented by one party to a contract, who terminates the agreement against the will of the other party, the latter may either sue for breach of contract, and recover as damages the profits he would have made if allowed to complete the work; or he may waive the contract, and bring his action on the common count for work and labor generally, and recover what the work done is actually worth; but in this case he cannot recover his profits on the unexecuted part of the work."

The owner may abandon his contract by failing to live up to his agreement or he may prevent the contractor from carrying out the work and fulfilling the agreement. Such a case as this was decided in Indiana. The owner of a building in course of construction having failed to pay the instalments on the work at the several periods when they were due according to the contract, was sued for damages by the contractor, who claimed that he had to abandon the work because of the non-payment of the instalments. The court's opinion in the matter was somewhat to the effect that if the owner had really prevented the contractor from fulfilling the agreement, then he should be able to recover as damages the profits that would have accrued to him, provided he had completed the job; but that the mere non-payment of instalments due on the contract before the work was finished did not constitute such prevention.

There are numerous other instances where it has been held that the contractor was unable to fulfil his part of the agreement on account of the owner failing in some way, either avoidable or unavoidable, to live up to the contract. In all such cases, where it can be proved that the contractor

was willing and ready to comply with his part of the agreement and was prevented by the owner from doing so, the courts seem to hold the opinion that he is entitled to recover not only for the actual work done but also for any profit that he would have received on the completion of the contract. For instance, should certain ironwork be ready for a building at the stipulated time, and should the building, which was not in a condition to receive it, burn down, the parties furnishing the ironwork would undoubtedly be able to recover the contract price, less the cost of erection; for they had completed their agreement as far as it was possible and within their power, further completion being impossible, owing to the failure of the owner to have his building ready in time.

33. Death of Either Party.—The death of the contractor ends the contract unless some provision is made in the agreement by which his heirs or executors become responsible for its completion, and the court in Missouri has decided that no lien can be taken out against the building for work or materials thereafter furnished under the contract. The contractor seems in this case to have the advantage, as the death of the owner does not affect the contract, because it is binding against his estate.

Where the contracting parties wish to guard against any of the foregoing contingencies, all that is required is the insertion of a clause in the contract that will convey their mutual intent and meaning in regard to the matter considered, and the court will see that it is enforced irrespective of general principles and precedent.

34. Abandonment Not Always Justified.—Before taking so serious a step as to abandon a contract, the contractor should be sure of his position and determine whether he is justified in such a proceeding, for, as expressed by the Supreme Court of Missouri, "A mere breach of contract does not entitle the other party to stop work and recover for unperformed work. He might stop work and recover for what he has already done, but not for what remained to be

done. To recover for that, he must have been prevented from going on by the unauthorized interference of the other party. The measure of damages on the contract, in such cases, is the contract price, less what it would cost to complete the work."

35. Forfeiting of Contract.—It sometimes occurs that one of the parties of a contract may find it impossible to fulfil the terms of the agreement owing to the conduct of the other party. In such a case, he should notify the other party immediately, declaring his unwillingness to be bound by the contract, or at least by certain stipulations in it; if he fails to do this promptly, it may be held that by his silence he waived his right to do so. For instance, a contractor may have been unreasonably delayed and interfered with by the owner's demands requiring a number of changes, or by the owner's withholding his decision on certain important questions, which prevented the contractor from proceeding with the work and completing it in the specified time. This being the case, the contractor is entitled to rescind the agreement, but he should do so at the time, or it may be held that he has waived his right to do so.

Instead of the owner being at fault, the contractor may fail to have the building finished at the stipulated time. This might give the owner the power to rescind the contract, but he should exercise this right at once; for should he fail to do so, and permit the contractor to proceed with the work, it would very probably be held that he had waived his right, and all that he could claim would be damages for injury due to the delay caused by the failure of the contractor to complete the agreement at the specified time, as provided in the contract.

Before entering on an agreement, the contractor should ascertain whether the plans and specifications call for work that can actually be constructed and whether the conditions are such that they can be carried to completion. Anything that is not clear to him from the plans or specifications should be explained to his satisfaction by the architect;

otherwise, if he should find, after signing the contract, that he cannot in any possible way carry out the work as shown, the court will very likely hold that he, being a responsible builder, should have known whether the plans could be carried out and that he was bound by the contract.

36. Reinstating Contracts.—Any contract that has been declared forfeited under the terms of the agreement may be reinstated by the mutual consent of the parties concerned, in which case they will no longer be governed by the annulment.

FRAUDULENT CONTRACTS

37. Statutes of Frauds and Limitations.—In the several states, there are codes of special laws known as the "Statutes of Frauds and Limitations." The particular clause in these statutes of interest to those engaged in building operations is here quoted from the statutes of Maine and reads as follows: "No action shall be maintained upon any agreement that is not to be performed within 1 year from the making thereof." That is to say, no contract shall be valid (unless in writing) that calls for an accomplishment of certain things that cannot be fulfilled within 1 year from the date of making the contract. The decision of a New Hampshire court is interesting in that it held that if the performance of the contract could be accomplished within 1 year (even though it was improbable that it would), the contract was not within the statutes and did not have to be in writing. The language of the court in this case was: "The Statute (of Frauds) does not apply to any contract, unless by its express terms, or by reasonable construction, it is not to be performed—that is, is incapable in any event of being performed—within 1 year from the time it was made. If by its terms, or by reasonable construction, the contract can be fully performed within 1 year, although it can only be done by the occurrence of some contingency by no means likely to happen, such as the death of some party or persons referred to in the contract, the statute has no application, and no writing is necessary.

If the agreement can be fully performed by either of the parties within 1 year, and it is so performed, the agreement of the other party is not within the statute, though it may be impossible to perform it within 1 year."

A case once arose in New York where the question involved was as to whether the terms of a verbal agreement prevented the possibility of the contract being completed in 1 year. The contract was made about 15 months before the date on which it was verbally agreed that the building should be completed. Some misunderstanding in regard to the agreement arose, and, in the suit that followed, the defendant claimed that the contract was invalid under the "Statute of Frauds." The claim was, however, denied by the Supreme Court, which rendered the following decision: "The agreement set forth in the declaration in this case is not for the building of a house after the expiration of 1 year, but is to be performed at the farthest within 15 months. There is nothing in the agreement prohibiting the defendant from completing the contract within 6 months, or a shorter period. Suppose he had done so, and sued the plaintiff for compensation for his labor and materials found, would it have been permitted to the plaintiff to have said that the contract was not to be performed within 1 year, and therefore it was not obligatory on him? Most clearly not. And if obligatory on one party, it is equally so on the other. The defendant might have performed the contract within 1 year, and it is therefore not within the statutes."

38. Fraudulent Contracts.—It is generally supposed that where a man has signed a contract he is held responsible and there is no escaping its conditions. However, if it can be proved that fraud was used in gaining his signature or that he was wilfully deceived in some manner, the court will deal fairly with him, and, as far as possible, will usually prevent the fraudulent party from gaining an advantage; for the court fully realizes that no matter how carefully a man may conduct his business transactions, no amount of care will protect him against frauds. The court, however, will

have little patience with any one that, through carelessness, allows himself to be imposed on. Even in cases where no fraud is intended and a mistake exists, if it can be proved that no usual amount of care could guard against it, the law will make an effort to correct the mistake and release the innocent parties if it can be done without dealing unjustly with the other parties, who may have been more careful.

When a party, before commencing the work, discovers that he has entered into a contract that misrepresents the amount of labor he is to perform or materials he is to furnish, he should, in order to avoid trouble, notify the other parties immediately that he repudiates the contract. If he should proceed with and perform the work, knowing that the amount to be done had been misrepresented to him, he would be unable to obtain more than the contract price. Where a stipulation in a contract, such as the time of completion, is misrepresented, or a mistake in the statement has been made, it has also been held that the balance of the contract remains intact, and that only such parts as are affected by the erroneous stipulations are invalidated. *A contract made on Sunday is invalid.*

COMPLETION OF THE CONTRACT

ACCEPTANCE OF THE WORK

39. Completion of Work.—The last, or final, stage in the fulfilment of a contract is the completion and acceptance of the work, which is often fraught with more misunderstanding and dispute than any other portion of the transaction.

Most contracts stipulate that the work shall not be deemed as completed until it has been accepted by some designated party, which is usually either the architect or the owner. If the architect accepts the work, he should furnish a certificate to the builder to that effect. Should the owner be the one who accepts the work, he should do so in writing. In some cases, it is required that both the architect and the owner should accept the work. It is well to stipulate in the

contract that all work shall be subject to the approval or satisfaction of the specified architect or architects. This clause is valuable in that it leaves all unsettled matters in regard to workmanship and materials to the architect's decision and sustains his authority as a final judge. If his judgment has been given in good faith, and with an intention to deal fairly with both his client and the contractor, there will be no necessity for subjecting the controversy to settlement by arbitration or trial by jury, for the court nearly always accepts the opinions and decisions of an honest and conscientious architect.

Where it has been stipulated in the agreement that "the work shall not be considered complete until certified to by the architect," most courts will hold (though there are exceptions to this rule) that the contractor must present a certificate from the architect before he will be able to claim that the contract has been completed. Even though the contract especially stipulated that the architect's certificate was to be binding and conclusive on both parties, such is not always the case; for, if it can be proved that the architect fraudulently or unscrupulously withheld it, or, in failing to grant it, was not acting according to his best judgment and was prejudiced against the builder, intending to oppress him, the court may hold that the architect's certificate is not necessary to the completion of the contract.

The architect is always subordinate to the contract. He cannot cause work to be done at variance with the stipulations in the contract; neither will his certificate for work that does not fulfil the requirements of the agreement be valid, and, though he has the power by the terms of the agreement to reject or accept all work as he may see fit, he is not authorized to reject any work that is done according to the agreement nor accept any work that is not.

The usual certificate is a blank filled out by the architect, which states that, in the opinion of the architect, the contractor is entitled to so much money for work done since the last certificate issued or since the beginning of the work. The certificate usually calls for about 90 per cent. of the estimated

value of the work done during the previous period, and also states that it is an expression of opinion and does not imply legal responsibility. This certificate might well state also that its issuance does not imply the acceptance of any work not in accordance with plans and specifications.

40. Accepting the Work.—The acceptance of work by either the architect or the owner is not always a waiver of the defects that may exist in it; though it may sometimes be implied from the owner's conduct, where the defects have been obvious and he has made no objections to them, that he accepts the work. But, should the defects be concealed, neither the owner's virtual nor formal acceptance will prevent him from recovering on the ground that the contract was not completed. In regard to this, the following view is generally taken by the courts: "Notwithstanding acceptance, virtual or formal, unless expressly made in full discharge of the contract, if the work or materials are not as contracted for, the owner may recover damages sustained in consequence."

A case involving this principle occurred in Georgia about the year 1854. It seems that a contractor undertook certain work for the trustees of a university. The contract was made in regard to some repairs and the remodeling of a certain building, and required that the contractor should "remove certain walls and put in such pillars as might be necessary to support the ceilings"; also, that the work should be completed "in a neat and workmanlike style." The repairs and alterations had been completed and virtually accepted by the trustees, who were present during the time the work progressed and had made no objections to it. About 18 months afterwards, one of the wooden girders put in according to the contract failed, and this so injured a portion of the ceiling that extensive repairs were necessary. In the suit instituted by the trustees for damages, testimony was introduced by the defendants to the effect that several days previous to the accident a leak had been discovered in the roof, and that the leakage so increased the weight on the girder as to cause it to fail. The plaintiffs proved, however,

that the chestnut girder was of a brashy nature and knotty, and further expert evidence was introduced to prove that it was of insufficient strength and that the ceiling should have been supported by several more posts.

41. The Right to Recover.—The lower courts decided in favor of the defendants in the foregoing case, but the decision was reversed by the Supreme Court, which held "that the fact that the plaintiffs received the work, and paid for it, does not affect their right to recover in the slightest degree; it is not a circumstance to be considered against that right. They are entitled to recover, unless they, at the time of the acceptance, knowing of the defective and neglected work, and of the non-compliance by the defendants with their contract in all respects, expressly waived a performance of the contract, and agreed to pay the stipulated prices, notwithstanding; all of which must be made affirmatively to appear by the defendants, to be available to them as a defense. * * * The evidence in this case falls very far short of this. Was the attention of the plaintiffs called to the fact that an important girder was brashy, knotty, and entirely incapable of supporting the weight resting on it? * * * Their attention was not called to it, and they could not see and examine the girder for themselves, for it was concealed from their view by the floor on one side and the overhead ceiling on the other."

One of the claims of the defendants was that the insufficiency of the pillars was self-evident, and that the plaintiffs must have observed the defect. In reply to this, the court said: "True, they could see the number of pillars, but they were not informed as to the number necessary. The defendants undertook specially, in their contract, to put in 'such pillars as might be necessary to support the ceiling'; they were to judge, and to judge correctly, at their peril. * * * The idea that they (the plaintiffs) were waiving any of their rights under the contract, never entered their minds; * * * they accepted the work because they believed that the defendants had complied."

42. Occupancy or Possession.—There is a general understanding among builders that if the owner moves into or occupies the building constructed under the contract, an acceptance of the work is implied. Such, however, is not always the case, as many decisions of the courts show. Even should he pay the contractor in full without demanding the architect's certificate or otherwise formally accepting the building, it could be held that no implied acceptance was meant.

In a case where a contractor had failed to comply with some material part of the contract, the parties for whom the work was done moved into the building and refused to pay the balance due the contractor; the contractor entered suit on the ground that the parties, by occupying the building, virtually accepted the work. The New York Court of Appeals, however, held "that if a contractor has neglected, and refuses, to complete his contract in a material point, it does not follow that the owner waives its performance by taking possession of, and occupying, the building in its defective condition." The court also said: "An owner is not put to so absurd an alternative as either to lose and abandon his building, worth perhaps $10,000, or to occupy it at the peril of paying for work not performed, or of waiving thereby the performance of any substantial covenant of the contractor." The New York courts also hold that "the occupancy of a building is not a waiver of the plain requirements of the contract."

PENALTIES AND PREMIUMS

43. Liquidated Damages.—The owner is often put to considerable inconvenience, and in some cases needless expense or loss, by the delinquency of the contractor to have the work finished at the stipulated time. For instance, it may be that the parties are having the building erected for their own occupancy, and that the lease on the property that they are occupying expires about the same date as that on which the contractor is to have the new building completed;

or it may be that the building is to be rented to tenants that expect to occupy it by a certain date, and have made arrangements accordingly. Hence, it is evident that the owner or owners may be placed in a very awkward position and perhaps compelled to sustain considerable financial loss, entirely due to default of the contractor in not having the work completed on time.

To guard against such a contingency, it is usual to provide in the contract, that the person doing the work shall pay a certain sum of money per day to the owner for each and every day beyond the stipulated time of completion that the work may remain unfinished. All contracts usually specify that this stipulated sum of money or forfeiture shall not be regarded as a penalty, but is to be considered as **liquidated damages** (liquidated damages simply meaning damages that are fixed by the terms of the contract, as opposed to unliquidated damages, which are decided on subsequently by jury or other means). The Supreme Court of Alabama, in regard to such forfeitures, says: "The court must ascertain whether the true intention of the parties was to afford fair and reasonable compensation for the loss sustained, in which case it is a real penalty, which can be apportioned to the actual loss sustained; or liquidated damages, which must be suffered without regard to actual injury resulting from failure to keep the contract. The tendency of the law is to regard the stipulations as a penalty, rather than as liquidated damages, and, if there is any doubt as to the intention of the parties, it will be so construed; and even if the stipulation is for payment of a sum in gross in case of failure to perform, the sum stated will still be considered as a penalty." It would seem from this decision that there is a difference expressed between a penalty and a forfeiture for liquidated damages. A penalty is regarded merely as a sum to be forfeited, out of which the actual damages are to be taken; while by liquidated damages is meant a sum usually agreed to by the contracting parties as the amount to be considered as actual damage. The purpose in regarding the forfeiture as liquidated damages is to avoid subsequent dispute as to

the amount of the real loss suffered by the owner; and it is commonly thought, where expressly stipulated that the forfeiture is to be considered as liquidated damages, that the courts would not interfere to invalidate the valuation that the parties had mutually agreed to in the contract.

44. Just Compensation.—Many of the highest courts in the land, however, look on all time forfeitures as mere penalties out of which the actually ascertained damages are to be taken, whether they are stipulated as liquidated damages or not. In such decisions, the owner is entitled to only such a sum as would fairly represent the loss he had sustained, and no unreasonable forfeiture could be collected.

Should it be proved that the owner endeavored to make profit out of a forfeiture clause, even though the forfeiture each day was qualified by the phrase that it was to be considered not as a penalty but as liquidated damages, it is more than probable that the court would not uphold him, and would decide, as previously stated, that all he was justly entitled to would be damages amounting to the actual loss he sustained by the default of the contractor. This was decisively settled by the Supreme Court of Michigan, which formulated the following rule: "The principle at which the law aims in awarding damages is that of just compensation for the injury sustained; and the parties will not be permitted by express stipulations to set this principle aside."

Even should there be no stipulation in the contract to the effect that the contractor was to forfeit a certain sum as liquidated damages for each and every day the work should remain unfinished beyond the specified time, the owner would be able to recover, as damages, any loss that he could prove to have actually existed through the default of the contractor.

45. Forfeiture Clause in Contracts.—The following assumed case will illustrate to what extent the contractor is responsible in regard to the forfeiture clause in contracts. An owner contracts with a party for the erection of a summer cottage and stipulates in the contract a

reasonable forfeiture, to be paid by the contractor, provided it is not completed by a certain date, thinking that in this manner he will stimulate the builder to an extra effort. The builder fails to have the cottage done on time, and suit is entered by the owner for the amount of the forfeiture, which is out of all proportion with the importance of the job. The court will very likely hold that he can recover only the day rent of the cottage for each and every day over the specified time, provided the delay has not been serious; and if the time of completion has so far exceeded that specified that the owner has been compelled to abandon the cottage for the summer, the court will more than likely award him damages to the amount that would be required to rent a similar cottage for the season. Again, it may be that the building is to be rented, and for every day over the time specified that the builder fails to have it completed the owner is out just so much rent; in that case, the court will award him the amount that he has lost in rents, with any other loss he may have sustained through invalidated leases with the tenants. Therefore, since it is very generally accepted by the courts that in any case only just damages can be recovered, the best thing that the owner or architect can do in stipulating the terms of the contract, where it is important that the work should be completed by a specified time, is to carefully estimate, as nearly as possible, the actual damage that will occur from the non-completion of the contract, and to add to this a reasonable margin for unforeseen contingencies. This amount should be obtained in a sum of so much a day, and should be inserted in the contract as a forfeiture clause for liquidated damages; then, were disputes to arise, this forfeiture clause would be upheld by the law if the amount was reasonably correct.

46. Unfinished Work.—The stipulation providing that a forfeiture shall be paid for delay in the completion of the building is of some advantage to the contractor; though, at first sight, it might not appear so. This advantage is due to the fact that, as a stipulation is made in regard to the

forfeiture of a sum of money for each day that the work shall have been delayed beyond the contract time, and such a forfeiture is agreed to by the builder in signing the contract, the owner must necessarily waive his right to rescind the contract on the ground that the work was not completed on time. If, however, no such forfeiture clause exists, the failure of the contractor to have the building finished in the specified time is a breach of the agreement, and the owner may rescind the contract. Thus, the builder, or contractor, loses his final payment for the unfinished portion of the work. Should the owner, however, fail to notify the contractor of the termination of the agreement on the day specified for the completion of the work and allow him to proceed with the job, he cannot do so subsequently, as he has waived his right in this direction. The courts have ruled, in regard to this, that "when the owner permits the contractor to continue work after the expiration of the time within which the work was to be completed, he waives the right to rescind the contract on that ground, but does not thereby waive such damages as he may have sustained by reason of the delay."

47. Reasonable Time.—When no specified time for the completion of the work has been provided in the contract, it might be supposed that the contractor could delay his work indefinitely; such, however, is not the case, for a **reasonable time** is always presumed to be understood, though just what constitutes a reasonable time is somewhat uncertain and will depend on the jury before which the case is tried. If would not be safe, therefore, where there is no time stipulation in an agreement, for a contractor to delay very considerably the completion of the work; for, should the owner's patience fail, and he bring suit, the jury is likely to decide that the contractor had been allowed more than a reasonable time for the performance of the work, and the owner could recover damages for the delay over the time held by the jury as being reasonable.

Should the owner waive the stipulation in regard to the time of completion, or his claim for damages due to the

delay, or any other stipulation or clause, it must not be thought that the other provisions in the contract are waived, or that the contract is invalidated thereby. Such is not the case, and it may be expressly stated that the waiver of one stipulation of a contract does not affect the others.

48. Delays.—It is not unusual for the contractor that has agreed to have the work completed by a certain date to be delayed, and thus prevented from complying with the contract, through the fault of other contractors or of the owner. Where the delay has been caused by the default of other contractors, it seems to be held, as a rule, that the contract is subjected to implied modifications in regard to the time limit, an extension of the time equal to the delay caused by the other's fault being allowed to the principal contractor. This is substantially the same as was held in Illinois when the court stated: "Where one contracts to do certain work in such a way as not to delay other contractors, and to have it done on a certain day, and, by delays of other contractors, is unable to commence it until near the time of completion, he is still held to the contract, except as to time of completion, and for unnecessary delay on his part will be liable to his employers for damages."

Should the delay be caused through the fault of the owner, the contractor will not only be entitled to an extension of the time limit, but should he on the same account be put to additional expense, he will be able to hold the owner for such, unless the contract provides that the owner shall have the power to postpone or delay the work as he may see fit. When, however, the contractor finds that the owner or the other contractors are causing him delay and additional expense, he should notify the owner to that effect immediately, so that the owner can take steps to prevent the delay, or so enjoin the other contractors that they will remove the cause of the complaint, and hence the additional expense to the complainant.

49. Non-Fulfilment of Contract. — The owner, on finding that the work is not progressing rapidly enough, due

to neglect or inability on the part of the contractor, may, on giving due and proper notice to that effect, employ other parties to finish the contract, and in due justice to himself may, in order that he will not lose the advantage of the contract, pay these parties out of the contract price or charge the cost to the original contractor. Carefully written contracts usually provide in some manner for this contingency and make special provision in regard to the terms and circumstances that will authorize the owner to take such a step. The rights of the contracting parties in regard to this are clearly expressed in the following decision of the Supreme Court of Illinois: "If one party induces the other to believe that he has withdrawn from the contract, the other need not wait for the day of performance before making new arrangements, nor does he lose his remedy against the delinquent party by providing at once against losses likely to arise against such delinquencies."

The owner, in taking the work out of the delinquent contractor's hands and completing it himself, or through another contractor, must see that it is done within a reasonable expense. In fact, since the original contractor has to pay for the subsequent work, his money is really being used, and the owner should guard it as he would his own, avoiding extravagant or wasteful expenditures; for, should it be proved that he was careless in this respect and attempted to charge an unreasonable sum against the original contractor, the courts would not uphold him. If the owner choses, he may complete the building by day work, or he may make arrangements with another contractor to do so at a reasonable price; but he must keep a careful account of the actual expenditures, and charge nothing else against the original contractor.

Should the owner, after rescinding the contract according to the provisions in it, or on good and sufficient reasons, find that some of the original contractor's work is defective, he may make good such work, and charge the expenditures to the cost of completing the building. If there are materials on the site of the new building furnished by the original

contractor, and these materials are good in every respect and substantially as specified or contracted for, the owner is bound to use them in completing the work, and thus avoid charging the original contractor the cost of such materials, which may be of less or no value on other work.

In well-drawn contracts, however, provision is generally made that where the contract is forfeited and materials are left on the ground by the original contractor, they shall be used at the discretion of the owner or the architect.

Even where the contract has granted them the authority, the owner, and the architect as well, should carefully consider the circumstances and all the stipulations relating thereto before taking so serious a step as the forfeiture of a contract. Where no provision has been made in a contract with regard to the contingency of its forfeiture, the owner or the architect, as the case may be, should, when there is good reason to do so, notify the contractor that he has forfeited his right to complete the contract. The owner should also endeavor to show an intention of finishing the work according to the terms of the contract, at a minimum cost to the original contractor, and protect his interest in every possible way.

50. Terminating a Contract.—An architect was once authorized in a contract to terminate it if he should see fit; the contractor applied to court for a decision as to whether the architect had a right, under the circumstances, to forfeit the contract. The architect held that he had the right to declare the contract forfeited under the terms of the agreement; but the court decided that the contractor had the privilege to apply to the court for its decision as to whether the architect was justified in terminating the contract.

The termination of the contract and the completion of the work by the owner or his representative somewhat changes the position of the architect. In a case where a subcontractor had entered suit and the work was being finished by other parties designated by the owner, who had rescinded the original contract, a New York court held that the certificate

of the architect, which was required under the original contract before payment would be made, was not required, as the owner was now his own contractor.

51. Premiums.—Premiums are sometimes offered where the work is of special importance, and are stipulated in the contract as being payable to the contractor at so much a day for each and every day that he shall have the work finished before the specified time. Such a clause is sometimes included with a liquidated-damages clause. Where such premiums are stipulated in the contract and the owner in some way unreasonably delays the work, thus preventing the contractor from completing it before the specified time and depriving him of the premium, the courts have held that he can recover, provided he can prove that he would have finished before the specified time if the owner had not interfered.

The difficulty, however, in such cases is in determining just how long before the stipulated time the contractor would have finished if the owner had not interfered. This at best is mere guesswork, and depends on the circumstances surrounding the case. Where the stipulated premium amounts to a considerable sum of money for each day gained, the importance of correctly determining the exact number of days may readily be seen. For instance, in one case the stipulated premium was $500 a day for each and every day the contractor should have the work completed before the specified time; the owner interfered, and the contractor entered suit, claiming that without such interference he would have gained considerable premium. The court decided that he could have finished 30 days before the stipulated time and awarded him the $15,000 due him.

EXTRA WORK

52. Extra Work: Verbal Understanding.—In a case brought before the Superior Court of Massachusetts, where the written contract stipulated that no extra work would be paid for unless ordered in writing, and where the contractor had done extra work on verbal orders and been refused

payment, the court held that "attempts of parties to tie up by contract their freedom of dealing with each other are futile. The contract is a fact to be taken into account in interpreting the subsequent conduct of the plaintiff and defendant, no doubt, but it cannot be assumed, as a matter of law, that the contract governed all that was done until it was renounced in so many words, because the parties had a right to renounce it in any way, and by any modes of expression they saw fit." In expressing the foregoing decision, the court was undoubtedly governed by the facts of the case, which were that most of the work was done after the original contract was practically completed, and the extra work, which was done during the completion of the original contract, had been verbally agreed to and payment had been promised for the same. Hence, in this case, the point to decide was not so much the setting aside of the stipulations requiring all extra work to be ordered in writing as it was whether the stipulations in the original agreement applied to subsequent and apparently independent work.

A similar case came before the Federal Court, where suit was entered by a contractor to recover payment for extra work, which the government had refused because the contract stipulated that no extra work should be paid for unless agreed on in writing. The court held that such a clause was inserted by the government in order to limit the powers of the architect and the superintendent, and did not bind the parties in such a manner as to avoid a verbal or implied agreement for extra work. The judge further stated: "Courts cannot transmute a contract into a statute of frauds, nor attach to the agreement of the parties the irrevocable mandatory attributes of a statutory provision. A provision in a written contract declaring that no claim for extra work shall be made unless it was required and agreed upon in writing, is merely a condition, which may be waived by a subsequent oral agreement." Also, "Where a public agent requests a departure from an express contract, and the change ordered is of such a nature that he may reasonably suppose that no additional expense will be caused

thereby, the contractor is bound to speak, or he will be deemed to have consented to make the substitution at the contract rate. But where the change is of such a nature that it must necessarily involve additional cost, no such notification is necessary, and the contractor will recover reasonable compensation."

It would not be safe, however, to omit the clause in the contract that provides that "no extra work shall be paid for unless ordered in writing," for many courts have held that such a clause cannot be broken with impunity; and where it can be proved that the real intention of the parties concerned was that all such orders for extra work should be made with due formality, the contract is valid and will be upheld by the court.

53. Extra Work: Written Agreement.—Often there is found in the contract two apparently contradictory clauses: one that implies that no extra work shall be paid for unless ordered in writing, and another that states that the engineer or the architect shall have power to direct additions to, or alterations in, the work. The court has decided, however, that in such cases the latter clause does not in any manner affect the validity of the first. A New York court refused to admit evidence where the contract provided that "no extra work shall be paid for if not ordered in writing," unless the parties could furnish the written orders for such work.

In emergencies, where the safety of the building is at stake, and the architect or the engineer may deem it necessary to verbally order extra work done to eliminate such danger, the contractor would more than likely be able to recover payment for the extra work, even though there was a stipulation in the contract that written orders would be required for all extra work. In order to illustrate in what light such a condition of affairs is held by a court, the following may be of interest: A county commission in Indiana appointed a supervising engineer to superintend the erection of a certain bridge to be built under contract. During its erection, the superintendent thought it advisable to do the work in such a

manner that a considerable amount of extra masonry and filling was required. The contractor being unable to collect for the extra work entered suit. The county commission claimed that the county could only be bound by the contract, and were responsible for nothing outside of it. The case was carried to the Supreme Court, which based its decision on the statutes applying to the erection and repair of bridges, which set forth that "for the erection of any such bridge, the said board shall appoint one or more discreet persons as superintendents thereof," and further authorized that the superintendent should have the power to receive proposals, let contracts to the lowest responsible bidder, and require surety for the performance of the agreement. On this, the court found that "it is thus seen that the superintendent has power to let contracts for the construction of bridges, and to superintend the work. We think that this makes the superintendent the agent of the county for the purpose of the construction of the bridge or bridges, and that he may bind the county by requiring work to be done beyond that contemplated by the contract. Such authority in the superintendent is necessary for the county, in order that the structure may turn out to be substantial and lasting; and it is proper, in order that the contractor employed to perform the extra work may have a remedy therefor. If it should be foreseen by the superintendent, after the letting of the contract, that the work performed or contemplated by it would be insufficient or defective, the county might be greatly the loser if he could not require such additional work as would make it substantial and permanent, and bind the county therefor." It should be distinctly remembered, however, that unless the contract expressly stipulates that an architect has power to order additional work, the owner will not be held responsible for payment for such work, unless, as stated in the preceding paragraphs, it is absolutely necessary for the safety of the building and well being of the owner. In such a case, the court, if passing favorably on the question at all, will very likely do so on the basis that the architect acted as the owner's agent, and as such had

authority in an emergency to order such extra work to save the owner from loss, and hence the owner would be required to pay for such work.

54. Advantage of Observing Extra-Work Clause. All parties concerned would be better off if the contract that expressly states that there shall be no extra work done unless ordered in writing were lived up to, for if such a stipulation is once broken, carelessness in this respect is likely to become the rule rather than the exception during the whole of the building operation, and when the settlement comes to be made there is trouble for both the owner and the contractor. It may readily be understood how, during a large building operation, where there is looseness in carrying out the contract stipulations for extra-work orders, there may be numerous misunderstandings in regard to the various verbal orders given. These misunderstandings frequently arise from the fact that, in the hurry and bustle of a modern building operation, the average contractor is likely to interpret the slightest wish or action of the owner as implying an order for extra work, and as the operation proceeds, the careless owner continues to express his wishes for the most trivial variations, not realizing that the possibly unscrupulous contractor is carefully keeping account of all such suggestions and figuring on collecting a good price for them as orders for extra work. Thus, a contract, when broken in whole or in part, is difficult to enforce again. In making the final settlement, the owner is often inclined to admit that certain of the verbal orders were valid, but to claim that others were not, because of no written order being furnished. This very contradictory condition of affairs is obviously unjust, and would be looked on with disfavor by any court, which would be likely to decide, as in a New York case, that "a written contract may be waived, either in whole or in part, by parol, and after it has been thus waived by one of the parties, neither he nor any one acting under him can reinstate it."

55. Estimating Charges for Extra Work.—In estimating the amount to charge for extra work, contractors are

likely to base their estimate at day wages; hence, it would be well to stipulate in the contract either that all extra work shall be paid for at contract prices or furnish some schedule on which the charge for extra work may be based. When the extra work is of the same nature as that specified in the contract, the usual custom is to itemize the estimate from which the contract has been made up and to charge all extra work accordingly. Usually when this is done the itemized schedule of prices for labor and materials is affixed to the contract and agreed to by the parties concerned as the basis on which all extra work is to be charged.

In a like matter to that in which extra work is ordered, omissions are sometimes made from the work required by the original contract. Where this is done, the amount of the deduction to be made from the contract price, on account of the omitted work, should be immediately agreed on with the contractor, and he, in deciding what will be a fair price to allow, must be governed by any stipulation bearing on the subject in the contract, and must also, if he wishes to deal honestly with himself, take into consideration any cost that may be caused by such omissions, which should be deducted from the allowance to be made to the owner.

Where no stipulation in regard to allowances for work omitted is made in the agreement, the views of the courts are very changeable as to whether the owner is entitled to any deduction. One court has handed down an opinion that "the defendant (meaning the owner) had a right to demand the very work specified, and if it accepted anything less as sufficient for the purpose named, has no right to insist that a rebatement should be made for that reason"; whereas, another court has held that "the owner is entitled to a reasonable compensation for work which has, by his desire, been omitted." It is evident, then, that all parties concerned would be better off if stipulations were made in the agreement in regard to deductions to be made from the contract price for work omitted, and on what schedule the prices by which the value of such work is to be estimated.

56. Decision as to Estimating.—A case often comes before the court that requires a decision as to how work shall be estimated. In such cases, the court is generally guided by the local custom in figuring such work, provided that this custom is well established among people engaged in building operations, generally understood by them, and reasonable in its results.

The Supreme Court of Missouri is agreeable to the custom that provides that in estimating for the laying of *stonework*, the door and window openings shall be measured as solid, and the corners measured twice. This same view is held in Maryland, with the further provision in regard to curved work, that it should be measured at one and one-half times its actual length. However, on account of the widely differing customs that sometimes exist in the same state, too much dependence should not be placed on the legal validity of any one of them.

57. Plaster Work.—A New York court once admitted evidence to prove that the custom among plasterers in Buffalo was to charge for the entire surface of the walls, without making any deductions for the window and door openings, cornices, or baseboards. A Pennsylvania court took another view of such work by saying: "A custom of plasterers to charge half the size of the window openings, at the price agreed on for the work and materials, is unreasonable and bad."

58. Brickwork.—Where brickwork was to be paid for by the thousand "in the wall," disagreements have arisen as to the method of counting the number of bricks, and, though the custom of allowing from twenty to twenty-two new bricks to a cubic foot of wall, or to a superficial foot of 12-inch wall, is well established among masons and bricklayers, the Supreme Court of Tennessee, in deciding such a case, would not admit it as evidence, and seemed to favor the actual count of the number of bricks used.

59. Excavating. Before a contractor makes an agreement to do "earth excavation" at so much a cubic yard, he

should always ascertain the nature of the soil, as otherwise he may discover when too late that the bulk of it is through hard pan, which will cost much more to move than ordinary earth, and which he did not figure on. If he should appeal to the court in an attempt to collect payment for the greater amount of work involved, he would more than likely find that his claim would not be sustained. Such a case was settled by the New York Court of Appeals, which decided that "earth excavation" included hard pan. A similar case arose in which an unfortunate contractor, who, having failed to examine the nature of the soil carefully, agreed to excavate and back fill a ditch at what would have been a very low figure even for earth. The contractor subsequently found that considerable of the excavation was in hard pan, and in some places rock. He commenced suit for the extra cost of the excavation, but the court would not admit evidence to prove the additional cost of the excavation, and said "it was the duty of the contractor to have ascertained the nature of the soil before entering into the contract; ordinary intelligence would have enabled him to do so."

60. Using Sand From Premises.—Sometimes a stipulation in the contract provides that "sand taken from the premises shall be used in the masonry." A New York court decided in a case of this kind, where the work was found defective on completion, due to the unsuitableness of the sand used, that the owner had no redress, though there was nothing in the report of the court to determine whether or not the contractor had notified the owner while the work was under way that the sand was not suitable. A good policy on the part of a contractor, however, would be to notify the owner in a similar case.

61. Quality of Materials.—It is not unusual to find in contracts that the quality of many of the materials to be used is not specifically stated. A New York court has decided that it is implied that they shall be of fair quality, or at least that they shall be sufficient and adequate. The decision of the court, as published in a law journal, is as follows:

"In every contract for the furnishing of the materials, and the performance of the work, in the absence of special provisions, there is an implied agreement on the part of the party who is to perform the work, and furnish the materials, that they shall not be of an insufficient and inferior description and value, and that the work shall not be totally inadequate to answer the purpose for which it was undertaken to be performed; and, though the agreement was that a specific sum should be paid for the work and materials, the claim may be reduced by showing that the work and materials were of an insufficient description and value, or it may be wholly defeated by showing that they were totally inadequate to answer the purpose for which they were to be furnished."

In regard to the stipulations in a Colorado specification that the "best lumber" should be used in a building, the Supreme Court decided that it meant the best that was ordinarily used in constructing buildings in that locality.

62. Old Materials.—A New York court, in regard to the ownership of old materials, said: "If the owner of land covered by houses, enters into a contract for the erection of other buildings on the same land, and does not provide for the use of the materials of the old building in the new, or does not remove them before the contractor takes possession under his contract, he will waive the right to them, and they will belong to the contractor."

63. Estimating Quantities.—The architect sometimes, though it is not usual for him to do so, prepares a bill of quantities of the material and labor that will be required in the construction of a proposed work. The contractor, however, should look with caution on such an estimate, even though the architect should assent to its correctness, and should verify for himself any such bill of quantities, unless, of course, the contract is simply for the execution of such a bill of material, instead of the erection of the building complete; for should the contractor base his agreement on this bill of quantities and afterwards find that the actual amount of material and labor required exceeded

the estimate, he would very likely find that nothing could be recovered through the courts.

Even in England, where the profession of "quantity surveying" is practised to a considerable extent and independent of the architect, the courts have held time and time again that no such estimate of the work was a guarantee, and that neither the quantity surveyor, architect, nor owner was responsible for its correctness. Hence, it would seem that there is no necessity for the architect to prepare any such bill of material, as the courts seem to be of the opinion that builders as a rule understand their business and are capable of making their own estimates, and should be responsible for them, provided the extent of the work is clearly stated to them by the architect or the owner through the plans and specifications prepared for the building.

RESPONSIBILITY AND RISK

BUILDER'S RESPONSIBILITY

64. Safety of Building During Construction.—The responsibility for the safety of a building during its construction usually devolves on the contractor, as has been decided in numerous cases. In a case where a contractor had entered into an agreement to raise a house and build under it another story, the building, while the work was progressing, fell and injured the adjoining property. The owner of the adjoining house entered suit for damages against the owner of the house undergoing alterations, but was defeated. The court held that the contractor was alone responsible, and said: "The distinction on which all such cases turn is this: If the person employed to do the work carries on an independent employment, and acts in pursuance of a contract with his employer, by which he has agreed to do the work on certain specified terms, in a particular manner, and for a specified price, then the employer is not liable. The power of directing and controlling the work is parted with by the

employer, and is given to the contractor." There are exceptions to this rule, however, where the courts have placed the blame on the owner; such a case was decided by the Supreme Court of Massachusetts. It seems, in this particular case, that a mason contracted to build a party wall. At the time the work was done there was freezing weather, and when the wall had progressed as high as the fourth story and the floorbeams were in place, the weather moderated, causing the mortar to thaw. The wall, thus softened, fell and damaged an adjacent building. In the suit that followed, the owner of the wall claimed that the contractors were alone responsible. Evidence was introduced tending to prove that the wall had not been properly braced, although it had been accepted by the architect as far as it had progressed, and also that the strength of the wall had been impaired by flues that were built in at the request of the owner of the adjoining property. The court, however, refuted the claim of the owner, that the contractor was alone responsible, by saying: "The general rule of law is that the person who, for his own purposes, brings on his land, and collects and keeps there, anything likely to do mischief if it escapes, must keep it at his peril; and if he does not do so is prima facie,* answerable for all the damage which is the natural consequence of its escape. This rule has been applied to dangerous animals, cesspools, to reservoirs, and to accumulations of snow and ice upon a building, by reason of the form of its roof."

Courts have generally held that where the fault or injury was due to the negligence of a subcontractor, the principal contractor was responsible.

If the contract provides that the building is to be erected according to certain plans and specifications, and the contractor agrees to such a stipulation, with the result that the building, when erected, is faulty and unsafe, courts have

* In law, a prima-facie case is one that is established by sufficient evidence, and can be overthrown only by rebutting evidence adduced by the other side—a case consisting of evidence sufficient to go to the jury; that is to say, one that raises a presumption of fact, and hence will justify a verdict, though it may not require one.

decided that the contractor cannot be held responsible if he has fulfilled the contract and carefully carried out the drawings and specifications. On the other hand, should he change the construction or deviate from the drawings or specifications, he is held responsible for the safety of the building.

65. Insurance.—The average contractor is called on to run numerous risks from fire, etc., which, if realized, would more than likely bankrupt him beyond any possibility of recovery. If the building should burn down or be subjected to destruction by any other unforeseen agency during the progress of construction, it is generally held that the contractor is responsible, and is bound by the stipulations in the contract, though the contract sometimes provides that should the contractor be delayed by such agencies as fire, water, cyclones, etc., an extension of time will be granted.

Hence, the duty of the builder, toward both himself and the owner, is to guard against such contingencies by taking out the proper insurance on the building. The Uniform Contract requires that the owner shall maintain the insurance necessary to cover the work and material incorporated in the building, and material upon the ground. The law is quite strict with contractors that have been so unfortunate as to have the building destroyed for which they contracted, and usually holds that they must finish the building according to the terms of the contract, no matter how severe it may be on them. When a building has been destroyed by some unforeseen agency, the courts have sometimes held that the builder was released from his contract by the "act of God," that is, by some power beyond human control. Such a case occurred in Connecticut, where a contractor had agreed to build a schoolhouse; it was nearly completed and $1,000 had been paid on account when it was struck by lightning and burned. The committee with which the contract had been made asked the contractor to commence rebuilding, and offered to extend the time of completing, which was nearly up when the fire occurred. The contractor, however, refused, saying that he had been released from the contract by an act

of God. The decision of the Supreme Court was against this, however, and held that he was not released.

66. Responsibility for Accidents.—The following rule of the Supreme Court of Illinois in a similar case, where the building under erection was blown down once and fell down the second time, caused, according to the contractors, by unforeseen defects in the soil, is interesting and explains itself: "If a party enters into an absolute contract, without any qualifications or exceptions, and receives from the party with whom he contracts the consideration of such an engagement, he must abide by the contract, and either do the act, or pay the damages; his liability arises from his own direct and positive undertaking. * * * If the covenant be within the range of possibility, however absurd or improbable the idea of execution may be, it will be upheld; as where one covenants it shall rain tomorrow. * * * To bring the case within the rule of dispensation, it must appear that the thing to be done cannot by any means be accomplished; for, if it be only improbable, or out of the power of the obligor, it is not deemed in law impossible. * * * No matter how harsh and apparently unjust in its operation the rule may occasionally be, it cannot be denied that it has its foundation in good sense and inflexible honesty. He who agrees to do an act should do it unless absolutely impossible. He should provide against contingencies in his contract. Where one of two innocent persons must sustain a loss, the law casts it on him who has agreed to sustain it, or rather, the law leaves it where the agreement of the parties has put it." The court further said, in reciting the case, "If a party for a sufficient consideration agrees to erect and complete a building on a particular spot, and to find all the materials and do all the labor, he must erect and complete it, because he has agreed to do so. No matter what the expense, he must provide such a substructure as will sustain the building on the spot, until it is completed, and delivered to the owner. * * * If the difficulties are apparent on the surface, he must overcome them. If they are not, but become apparent by excavation,

or the shrinking of the building, the rule is the same. * * * The cases make no distinction between accidents that could be foreseen when the contract was entered into, and those that could not have been foreseen; between accident by the fault of the contractor, and those where he is without fault; they all rest on the simple principle. Such is the agreement, clear and unqualified, and it must be performed, no matter what the cost, if performance be not absolutely impossible. * * * The whole defense was properly overruled, because it did not show the performance of the contract impossible, or any lawful excuse for non-performance of the contract."

ARCHITECT'S AND OWNER'S RESPONSIBILITY

67. Suits for Liability.—In the American Institute of Architects' and the National Association of Builders' official form of contract, given in full at the end of this Section, there will be noticed in Art. I a stipulation that the architect is "acting for the purpose of this contract as agent of the said owner." In case of suit for liability that might be entered against the owner by persons injured while working on the building, this clause is likely (and especially so under the laws of some states) to cause trouble; for a shrewd lawyer might trace every occurrence about a building as emanating directly through the orders of the architect, who, acting as agent, makes the owner responsible for such occurrences; and hence the particular one that led to the injury of the plaintiff.

Such a calamity may be guarded against by some such clause as is given in the first form of contract hereinafter referred to. This clause places the responsibility for liabilities on the contractor, and reads as follows: "The contractor shall furnish all transportation, scaffolding, apparatus, ways, works, machinery, and plant requisite for the execution of this contract, and shall be solely answerable for the safe, proper, and lawful construction, maintenance, and use of the same; he shall cover and protect his work from damages, and all injury of the same, before the completion of

this contract, shall be made good by him; and shall be solely answerable for all damage or delay to the owner or his property, to other contractors or other employes of the owner, to neighboring premises, or to any person or property, due to the improper, illegal, or negligent conduct of the contractor, or of his subcontractors, employes, or agents, in or about the said building or the execution of the work covered by this contract or any extra work undertaken as herinafter provided."

The architect is thus relieved of his position as agent in all cases that might place the responsibility for liabilities on his client by that portion of the clause in the same contract which reads: "Neither the architect nor any person employed by him shall have any control or direction over the progress of the work, excepting the power of rejecting it, nor any control or superintendence over the scaffolding, apparatus, ways, works, machinery, or plant, the sole responsibility for which shall rest with the contractor; and further, the architect shall not be deemed the agent of the owner for any purpose whatsoever, except as the owner may in fact give him a special and express authority."

Since most first-class builders have their liabilities insured, they would have no incentive to throw such responsibilities on the owner; but in order that the owner may be secure against any legal action by injured employes, the best plan would be to insert such clauses as are just given.

68. Architect's Responsibility for Work Not Conforming to the Specifications.—There is considerable difference of opinion shown in the decisions of the courts as to the legal responsibility of the architect for work that is not according to the drawings and the specifications. The consensus of opinion seems to be in favor of holding the contractor responsible for exactly complying with the drawings and specifications, and that the architect be held responsible for a reasonable degree of professional knowledge and skill, and that he devote a greater amount of care and attention to his employer's affairs than to smiliar work of his own.

The following decision by a New York chief justice, in an important case, states clearly what seems a very fair conception of the duties of the architect as the agent of the owner and his responsibility for work not executed according to the drawings and specifications: "The counsel would not contend that the architect is an insurer of the perfection of the masonwork, the carpenter work, the plumbing, etc. He is bound only to exercise reasonable care and to use reasonable powers of observation and detection in the supervision of the structure. * * * An architect is no more a mere overseer, or foreman, or watchman, than he is a guarantor of a flawless building; and the only question that can arise in a case where general performance of duty is shown, is whether, considering all the circumstances and peculiar facts involved, he has or has not been guilty of negligence. This is a question of fact, and not of law."

69. Architect's Responsibility for Defective Drawings or Specifications.—Where the architect has shown beams or columns on his drawings that are too weak to carry the loads placed on them, and the building tumbles down as a result, he would probably be held legally responsible. The weight of legal opinion seems to be in favor of making him liable for the consequences of what can be proved to be lack of ordinary professional skill and care in preparing the plans and specifications.

70. Importance of Insuring.—Where the rules of the insurance companies permit, the owner should insure his own and also the risks of all the contractors engaged on the work, which, in case of loss by fire, will be paid according to the particular interests of the parties engaged. See Art. XI, Form 3. Should the laws of the insurance companies not allow them to issue a policy in the names of more than one person, the builder should be required to insure to the full amount of his interest; and, since they are likely to neglect doing so for the sake of the financial saving, the architect should demand this policy and see that it is all that is required, retaining it in his hands for safe keeping.

The importance of a stipulation to this effect is evident; for if the builder should neglect to insure, and if the partly erected building should burn down, he would, in many cases, be thrown into bankruptcy and the owner would be compelled to finish the contract with the assignee or some other contractor.

71. Mechanic's Lien.—A **mechanic's lien** is a lien on real property, given by statutes in most of the United States, to mechanics and material men, for the price and value of improvements supplied by them. With reference to buildings, it is a lien given to mechanics and material men as security for their claims for work done or materials furnished, for and about the erection or alteration of the buildings.

A mechanic or a material man has no right to retain possession of a building until his debt is paid; he has a mere right to sue out and enforce his lien, and thus charge the property with the payment of his particular debt in preference to other debts, so far as the statute confers such preference, if all the requisites of the statute have been observed.

There can be no mechanic's lien unless the work done or materials furnished were done or furnished under or by virtue of a contract with the owner of the property, or some agent duly appointed by him. The contract need not be in writing, except when required by statute, and it need not contain any express stipulation for a lien, as the lien is given by statute independent of the terms of a contract. If the material man sells his materials with no understanding as to the purpose to which they are to be put, he can assert no lien on the building in which they are placed. It is only when the materials are furnished for a purpose mentioned in the statute that a lien is acquired.

The statutes of most states require that a notice be given of the lien, and docketed among the proper public records so as to give notice to the world of its existence.

In the majority of the states, the lien begins from the date of commencement of the building; in some states, the lien

commences when the labor or material is furnished to the building.

The duration of a mechanic's lien is, in all states, a matter of statutory regulation. In some states, the lien continues until the expiration of a definite period, usually 6 months, from the performance of the work, or the furnishings of the materials. If a formal claim is filed before the expiration of this period, the lien is continued for a period varying from 2 to 5 years.

In some states, the architect that draws the plans and superintends the construction of a building has a valid lien for his services. In other states, distinction is made between an architect that draws plans for a building only and one that superintends its erection, the latter being held to be entitled to a lien, but in some states no architect is entitled to a lien.

The mode for enforcing the lien is usually a matter of statutory provision. In some states this is done by a foreclosure of a mortgage, others require the filing of a bill in chancery, while other states authorize the issuance of an attachment. Whatever may be the proceeding prescribed, the person whose property is sought to be charged with the lien is given the opportunity to interpose any defense he may have.

LEGAL MEANING OF WORDS

72. "Commencement" and "Erection."—A question sometimes arises as to when a building is properly *commenced;* whether it is when the batter boards are set, when the excavation is started, or when the first footing stone is laid. The New Jersey Supreme Court held the opinion in two cases that a building was commenced when the excavation was begun.

The direct meaning of the word *erection* is somewhat obscure, and while it is a word much used in contracts and specifications, there seems to be a great difference of opinion in regard to what may be inferred by the phrase *upon the erection of.* Some hold that it means the completion of the building or structure; others claim that something else is

meant. A case in Illinois called for a decision from the Supreme Court as to when a building should be considered as being erected. The court decided that the building in question be considered as erected, although it had no roof on and not one gable or chimney was built; the flooring had not been laid, but the materials for the roof, floor, and windows had been delivered on the ground. In Indiana, the court held that a house had been erected wherein the plastering had not yet been done and some of the windows had not been placed; and most of the states in which such cases have arisen have held the opinion that a building was erected where the walls were up and the materials with which to complete it were on the site.

73. "**As Directed.**"—The expression *as directed*, as pertaining to its use in specifications in connection with the manner in which work shall be done, was passed on by the Supreme Court of Missouri during a controversy as to whose directions were meant, and was held to imply those of the owner. All controversy on this score can be avoided by stating whose direction is intended, the owner's or the architect's.

74. "**Not Less.**"—The phrase *not less*, which is much used in specifications, hence forming a term in the agreement, seems to be rather unnecessary in most cases, and is liable to cause trouble. It is principally used in making some such stipulation as this: "The cellar shall be excavated to a depth of not less than 10 feet." A stipulation like this was made in a contract for the erection of a building in the state of New York. After the contractor had excavated to the required depth, the nature of the soil demanded further excavation in the footing trenches, and in consequence the cellar wall had to be extended. In the suit brought by the contractor to recover the cost of the extra work, the Supreme Court decided that it was due him. In all cases of this kind, the court will carefully consider the meaning of the contract to determine whether the contractor really intended to bind himself to do the work beyond the given

dimensions should the architect, in the execution of the work, deem it advisable, owing to conditions unforeseen.

75. "More or Less."—A contract will sometimes stipulate that a certain amount of material *more or less* shall be furnished. A New York court held that the term as used implied the delivery and acceptance of just the actual amount of material required for the work, and that the term as used did not mean any definite quantity.

76. Other Phrases.—In most formal contracts, it is usual to refer to the specifications that constitute part of the agreement as the *specifications hereto annexed.* The courts hold that it is not necessary that the specifications should be actually attached to the formal contract; for so long as the particular specification referred to in the contract can be proved as the one meant, that is all that is legally required. Also, if the phrase, *the specifications signed herewith*, is used in the formal contract, it is not actually required that they should be signed, provided the ones intended in the formal contract can be identified without such signatures. It undoubtedly would be advisable, however, to sign all specifications, and even plans, so that there may be no controversy in regard to the ones designated in the formal contract.

FORMS OF CONTRACT

77. Specimen Contracts.—The preceding pages have been devoted to points of law likely to be raised in respect to contracts, the study of which will enable one, when called on to become a party to a contract, to do so intelligently.

The two forms of contract that are now given in full are representative and legally correct. The first form is very complete, provisions being made in it to cover every contingency that is likely to arise in an important building operation, and which long experience in building transactions has demonstrated should be guarded against. The second form is more brief, and not so complete in the extent of the ground covered, but is the one that is generally used.

This contract is the official contract of the American Institute of Architects and National Association of Builders, and is known as "The Uniform Contract." It is used in the printed form, which is obtainable at nearly all stationery-supply stores. It has been carefully compiled by a joint committee of the Institute and Association, and is subject to such change and modification each year as may be deemed necessary to make it more complete or binding.

78. Building Contract.—The text of the ordinary building contract herein first referred to follows:

BUILDING CONTRACT

between_____of_____
hereinafter called the Owner, and_____
of_____hereinafter called the Contractor, made
at_____the_____day of_____19____

The respective parties hereto, each in consideration of the agreements of the other herein set forth, agree each with the other as follows:

THE CONTRACTOR'S AGREEMENT

The Contractor, his heirs or assigns, agrees to_____

_____

according to certain plans and specifications prepared by_____

_____of_____Architect. Said plans and specifications, together with this contract, of which they are to be deemed a part, are to be construed together, so that any work shown on the plans, though not mentioned in the specifications, or vice versa, or any provision of the contract not repeated in the plans or specifications, or vice versa, is to be executed by the Contractor as a part of this contract. Figured dimensions are to prevail over scale measurements. All things which in the opinion of the Architect may fairly be inferred from the plans and specifications, are to be executed by the Contractor as a part of this contract. If complete drawings of details have not yet been made, the same, when made and conforming to said plans and specifications, are to constitute a part of this contract, the Architect being the sole judge as to whether said detailed drawings conform to said plans and specifications. All the plans and drawings received by the Contractor at any time during the continuance of this contract are at its termination to be returned to the Architect.

All material and work, where the quantity, dimensions, and quality are not shown on the plans or specified in the specifications, are to be furnished in sufficient quantity and of sufficient dimensions for the proper execution of the work as determined by the Architect, and the

quality and workmanship are to be the best throughout and satisfactory to the Architect.

The Contractor is to take out at his own expense all necessary permits from the municipal or other public authorities, to give all the notices required by law or municipal ordinance, and to pay all fees and charges incident to the due and lawful prosecution of the work covered by this contract.

If this contract involves excavation or masonwork, the Contractor is to execute the same without encroaching upon adjoining public or private property, and shall procure for the Owner the certificate of some competent surveyor, to be selected by the Owner, that there has been no such encroachment; unless the plans themselves provide for such encroachment, in which case the Contractor shall be relieved from all responsibility as to the correct location of the walls and foundations in this respect.

The Contractor shall devote his time and personal superintendence to the execution of this contract, and shall employ a competent foreman, who shall at all times be present while any work is being done under this contract at the building.

The entire work and all its parts, including material, workmanship, and rate of progress, shall be satisfactory to the Architect. All materials rejected by the Architect, whether worked or unworked, and whether affixed to the building or not, shall be removed from the premises (and for that purpose taken down if already attached to the building) at the request of the Architect; and all work condemned by the Architect, as in any way unsound or as not conforming to the terms of this contract, shall be taken down forthwith and rebuilt by the Contractor in accordance with the contract and in a manner satisfactory to the Architect. The Contractor shall dismiss any of his employes if the Architect considers said employes incompetent or careless and so informs the Contractor.

The Contractor shall clear away all dirt and rubbish caused by his operations as often as requested by the Architect or Owner, and shall leave the premises at the termination of this contract free from such dirt and rubbish and in a neat and clean condition.

The Contractor shall prosecute the work speedily and continuously

_____

_____

and the entire work covered by this contract shall be finished by the _____ day of _____ 19____ The damages for default are fixed at _____ dollars for every day thereafter that the said work shall remain unfinished.

The Contractor shall make good all defects, omissions, and violations of the terms of this contract whensoever discovered, during the progress of the work or afterwards, notwithstanding any payments

that may have been made, or any certificates that may have been given, or any possession or acceptance of the work by the Owner, and shall be responsible for any damages that may be caused in making good said defects, omissions, or violations.

The Contractor shall comply with all the laws, ordinances, and regulations for the time being in force in the city or town where the building is situated and relating to the building or other work included in this contract, and shall satisfy all the requirements of the Inspectors (if there be such).

The Contractor shall furnish all transportation, scaffolding, apparatus, ways, works, machinery, and plant requisite for the execution of this contract, and shall be solely answerable for the safe, proper, and lawful construction, maintenance, and use of the same; he shall cover and protect his work from damage, and all injury to the same, before the completion of this contract, shall be made good by him; and shall be solely answerable for all damage or delay to the Owner or his property, to other Contractors or employes of the Owner, to neighboring premises, or to any person or property, due to the improper, illegal, or negligent conduct of the Contractor, or of his subcontractors, employes, or agents, in or about the said building or the execution of the work covered by this contract or any extra work undertaken as hereinafter provided.

The Contractor shall have sole charge and possession of the work covered by this contract until the termination thereof; but shall permit the Owner and the Architect and any person employed by either of them to visit, enter, and inspect the said work at all times and places during the progress thereof, and shall provide safe and proper facilities for such inspection.

The Contractor shall permit other contractors or employes of the Owner to prosecute their work, and shall render them all necessary assistance.

THE OWNER'S AGREEMENT

The Owner, his heirs, or assigns agree to pay the Contractor in monthly sums amounting to 90 per cent. of the value of the work done during the previous month. These payments shall be made upon the presentation of certificates from the Architect; provided, however, that none of the foregoing payments shall be due or payable unless the Contractor shall deliver to the Owner the written certificate of some competent surveyor, to be selected by the Owner, that there has been no encroachment upon adjoining public or private property and unless the property is free from all lien for debts due, or claimed to be due, the Contractor, and satisfactory evidence thereof furnished (if requested) to the Owner by the Contractor; also with the understanding that making of any of these payments does not imply the acceptance of any work not in accordance with the drawings and specifications.

ALTERATIONS AND EXTRAS

The Architect may, in writing, and from time to time, order the Contractor to make any changes in the work which do not increase the cost to the Owner or affect the time of completion. In case said changes make the work less expensive to the Contractor, a proportional deduction shall be made from the contract price above specified. In no case shall any change be made in the work which shall increase the cost of the work to the Owner, or involve any extension of time, without his express and special consent; and, if the Contractor shall proceed to execute such change without first obtaining such consent, he shall be concluded against making an extra charge for the said change or any claim for further time.

In case of any change ordered by the Architect as aforesaid, or in case any other changes in the work are made by the mutual consent of the parties hereto, whether affecting the contract price or not, or the time of completion or not, all and singular the other provisions of this contract shall remain in force, and apply to the contract as thus altered.

ORDERS FOR PAYMENTS

If any orders are accepted by the Owner (and it is understood that he shall be under no obligation to accept any), such acceptances shall be conditional on the due performance by the Contractor of all and singular the provisions of this contract, and subject to alterations as aforesaid.

THE ARCHITECT

The Architect mentioned in this contract is understood to be _____ _____ of _____ or such other Architect as the Owner may hereafter select; any change to be notified to the Contractor in writing.

The Architect shall have authority to enter and inspect the work at all times, to reject all material (whether set up or not) and to condemn all work which in his opinion is not in conformity with the provisions of this contract, and to do all the things hereinbefore set forth as within his powers. Neither the Architect nor any person employed by him shall have any control or direction over the progress of the work, excepting the power of rejecting it, nor any control or superintendence over the scaffolding, apparatus, ways, works, machinery, or plant, the sole responsibility for which shall rest with the Contractor; and neither of them shall have power to order extras or alterations, except as above provided, or any authority other than that expressly set forth in this contract. The Architect shall not be deemed the agent of the Owner for any purpose whatsoever, except as the Owner may in fact give him a special and express authority.

MISCELLANEOUS PROVISIONS

No payment of money under this contract, nor any acceptance or possession taken of the work done by the Contractor, nor any certificate given, shall be evidence of the performance of this contract or be construed as a waiver of any of its provisions by the Owner; nor shall any waiver of any breach of this contract be held to be a waiver of any other or subsequent breach.

If, in the opinion of the Architect, the Contractor is obstructed or delayed in the prosecution or completion of the work by the neglect, delay, or default of any other contractor, or by any damage which may happen thereto by fire, or by the unusual action of the elements, or by the abandonment of the work by the employes in a general strike, then the Contractor shall be entitled to such extension of the time specified above for the completion of the work as the Architect shall in writing certify; provided, however, that claim is made by the Contractor at the time and in writing.

If at any time before the completion of this contract the Contractor becomes bankrupt or insolvent, or makes an assignment for the benefit of creditors, or assigns this contract or sublets any part of it without the consent of the Owner first obtained in writing, or becomes incapable of completing the contract, or shall at any time for six days refuse or neglect to proceed with the contract work in the manner herein agreed to the satisfaction of the Architect, then the owner may at once terminate this contract by a written notice delivered to the Contractor in person or at his usual place of business, and proceed to complete the work with other mechanics or contractors, and account to the Contractor or his legal representatives as follows: The Owner shall be credited with all payments theretofore made by him to the Contractor, with the entire cost of completing the work with said other mechanics and contractors, and with all damages by delay or otherwise, caused by the default of the Contractor, including reasonable expenses of counsel. If the contract price exceeds the total amount of these credits, the excess shall be paid to the Contractor or his legal representatives. In case orders accepted by the Owner are outstanding, the holders thereof shall be entitled to such excess in preference to the Contractor or his legal representatives. If, however, the total amount of the said credits exceeds the contract price, the excess shall be due from the Contractor to the Owner. In such accounting, the Owner shall not be held to obtain the lowest figure for the work of completing the contract; but all sums actually paid by him for such completion shall be credited to him.

All material delivered at the building by or on account of the Contractor, and intended to be incorporated with the building, shall become the property of the Owner as delivered; but the Contractor

may repossess himself of any surplus left at the completion of the contract. All scaffolding, apparatus, ways, works, machinery, and plant brought upon the premises by the Contractor, or used by him, shall remain his property, but in case of default and a completion of the contract work by the Owner, the latter shall be entitled to use the said scaffolding, apparatus, ways, works, machinery, and plant without cost or liability for depreciation or injury by use.

If the Owner does not make the payments herein provided as and when the same shall become due and payable he shall be liable to the Contractor for interest on the same; and if such default continues for a period of ten days, the Contractor may, by a written notice delivered to the Owner in person or at his usual place of business, terminate this contract. But the acceptance of any money under this contract subsequent to such defaults shall operate as a waiver thereof and of the right to terminate this contract by reason thereof.

The Owner shall keep the building and the material on the premises insured against fire in such companies as he shall select, for the benefit of himself or any mortgagee and of any and all contractors on the building who shall request such insurance in writing. The expense of said insurance shall be borne by the Owner; but he shall not be responsible for carrying too little insurance, unless the Contractor has requested him in writing to insure in a certain specified amount, and the Owner has neglected to do so for an unreasonable length of time. In the event of a fire, the insurance shall be divided between the Owner and any mortgagee and those contractors for whose benefit the insurance was taken out, as their interests may appear; and the parties hereto shall respectively proceed to the completion of this contract.

All disputes arising out of this contract or the performance or breach thereof shall be settled by mutual agreement or in a court of law or equity before a single justice, auditor, or special master, and no claim shall be made for a trial by jury on the whole case or special issues.

In witness whereof, we, the said _____
and the said _____
hereto set our hands and seals this _____ day of _____ 19___

79. Uniform Contract.—The so-called "Uniform Contract" adopted by the American Institute of Architects and the National Association of Builders is a printed instrument with spaces left for filling in the specific details peculiar to each case, as shown in Form 1. The lines left blank for the names of the contractor and owner are ample for the name and address of either party when it consists of a firm

or long-titled corporation. The lines near the bottom of Form 1 are for a list of the work included by the contract for the building to be erected, together with its location.

Form 2 is printed on the second page of the "Uniform Contract" and continues the terms of the agreement down to Art. VIII. In Art. VI, five lines are left for the dates at which various portions of the building shall be completed; and six additional lines are left blank to insert provisions for contingencies of delay, such as strikes, interference of other contractor, severe weather, etc.

Form 3 constitutes the third page of the "Uniform Contract" and contains, in Art. IX, space for the gross amount of the contract to be written in; under which are provided blank lines whereon to state the number, amount, and time of payment of each instalment of the contract price. Art. XI provides the insurance clause and leaves spaces for special conditions of insurance if such are required. Then follows the space for the signatures of the contracting parties, while under the words "In presence of" is placed the signature of a witness, who is usually, though not necessarily, the architect.

The contract is folded twice, after it has been signed, and on the outside of the fourth page is a blank form that, when filled out, gives information regarding the document, as shown in Form 4. This is not necessarily a part of the document, but it is simply an indorsement or title by which the contract may be recognized without unfolding it.

THE UNIFORM CONTRACT

FORM OF CONTRACT
ADOPTED AND RECOMMENDED FOR GENERAL USE
BY THE
AMERICAN INSTITUTE OF ARCHITECTS
AND THE
NATIONAL ASSOCIATION OF BUILDERS

_____
ARCHITECTS

This Agreement, made the _____ day of _____ in the year one thousand nine hundred and _____ by and between _____

_____

_____

_____

_____

_____ party of the first part (hereinafter designated the Contractor), and _____

_____

_____

_____

_____

_____ party of the second part (hereinafter designated the owner),

Witnesseth that the Contractor, in consideration of the fulfillment of the agreements herein made by the Owner, agrees with the said Owner, as follows:

ARTICLE I. The Contractor under the direction and to the satisfaction of _____ Architects, acting for the purposes of this contract as agents of the said Owner, shall and will provide all the materials and perform all the work mentioned in the specifications and shown on the drawings prepared by the said Architects for the _____

_____

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_____

_____

which drawings and specifications are identified by the signatures of the parties hereto.

ART. II. The Architects shall furnish to the Contractor, such further drawings or explanations as may be necessary to detail and illustrate the work to be done, and the Contractor shall conform to the same as part of this contract so far as they may be consistent with the original drawings and specifications referred to and identified, as provided in Art. I.

It is mutually understood and agreed that all drawings and specifications are and remain the property of the Architects.

ART. III. No alterations shall be made in the work shown or described by the drawings and specifications, except upon a written order of the Architects, and when so made, the value of the work added or omitted shall be computed by the Architects, and the amount so ascertained shall be added to or deducted from the contract price. In the case of dissent from such award by either party hereto, the valuation of the work added or omitted shall be referred to three (3) disinterested arbitrators, one to be appointed by each of the parties to this contract, and the third by the two thus chosen; the decision of any two of whom shall be final and binding, and each of the parties hereto shall pay one-half of the expenses of such reference.

ART. IV. The Contractor shall provide sufficient, safe and proper facilities at all times for the inspection of the work by the Architects or their authorized representatives. He shall, within twenty-four hours after receiving written notice from the Architects to that effect, proceed to remove from the grounds or building all materials condemned by them, whether worked or unworked, and to take down all portions of the work which the Architects shall by like written notice condemn as unsound or improper, or as in any way failing to conform to the drawings and specifications.

ART. V. Should the Contractor at any time refuse or neglect to supply a sufficiency of properly skilled workmen, or of materials of the proper quality, or fail in any respect to prosecute the work with promptness and diligence, or fail in the performance of any of the agreements herein contained, such refusal, neglect or failure being certified by the Architects, the Owner shall be at liberty, after _____ days written notice to the Contractor, to provide any such labor or materials, and to deduct the cost thereof from any money then due or thereafer to become due to the Contractor under this contract; and if the Architects shall certify that such refusal, neglect or failure is sufficient ground for such action, the Owner shall also be at liberty to terminate the employment of the Contractor for the said work and to enter upon the premises and take possession, for the purpose of completing the work comprehended under this contract, of all materials, tools and appliances thereon, and to employ any other person or persons to finish the work and to provide the materials therefor; and in case of such discontinuance of the employment of the Contractor he shall not be entitled to receive any further payment under this contract until the said work shall be wholly finished, at which time, if the unpaid balance of the amount to be paid under this contract shall exceed the expense incurred by the Owner in finishing the work, such excess shall be paid by the owner to the Contractor, but if such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, either for furnishing materials or for finishing the work, and any damage incurred through such default, shall be audited and certified by the Architects, whose certificate thereof shall be conclusive upon the parties.

ART. VI. The Contractor shall complete the several portions, and the whole of the work comprehended in this Agreement by and at the time or times hereinafter stated _____

_____

_____

_____

_____

_____

provided that _____

_____

_____

_____

_____

_____

ART. VII. Should the Contractor be obstructed or delayed in the prosecution or completion of his work by the act, neglect, delay or default of the Owner, or the Architects, or of any other contractor employed by the Owner upon the work, or by any damage which may happen by fire, lightning, earthquake or cyclone, or by the abandonment of the work by the employees through no default of the Contractor, then the time herein fixed for the completion of the work shall be extended for a period equivalent to the time lost by reason of any or all the causes aforesaid; but no such allowance shall be made unless a claim therefor is presented in writing to the Architects within twenty-four hours of the occurrence of such delay. The duration of such extension shall be certified to by the Architects, but appeal from their decision may be made to arbitration, as provided in Art. III of this contract.

ART. VIII. The Owner agrees to provide all labor and materials not included in this contract in such manner as not to delay the material progress of the work, and in the event of failure so to do, thereby causing loss to the Contractor, agrees that he will reimburse the Contractor for such loss; and the Contractor agrees that if he shall delay the material progress of the work so as to cause any damage for which the Owner shall become liable (as above stated), then he shall make good to the Owner any such damage. The amount of such loss or damage to either party hereto shall, in every case, be fixed and determined by the Architects or by arbitration, as provided in Art. III of this contract.

ART. IX. It is hereby mutually agreed between the parties hereto that the sum to be paid by the Owner to the Contractor for said work and materials shall be $ _____

_____

_____

_____

_____

subject to additions and deductions as hereinbefore provided, and that such sum shall be paid in current funds by the Owner to the Contractor in installments as follows:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

The final payment shall be made within _____ days after this contract is fulfilled.

All payments shall be made upon written certificates of the Architects to the effect that such payments have become due.

If at any time there shall be evidence of any lien or claim for which, if established, the Owner or the said premises might become liable, and which is chargable to the Contractor, the Owner shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify him against such lien or claim. Should there prove to be any such claim after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging any lien on said premises made obligatory in consequence of the Contractors default.

ART. X. It is further mutually agreed between the parties hereto that no certificate given or payment made under this contract, except the final certificate or final payment, shall be conclusive evidence of the performance of this contract, either wholly or in part, and that no payment shall be construed to be an acceptance of defective work or improper materials.

ART. XI. The Owner shall during the progress of the work maintain full insurance on said work, in his own name and in the name of the Contractor, against loss or damage by fire. The policies shall cover all work incorporated in the building, and all materials for the same in or about the premises, and shall be made payable to the parties hereto, as their interest may appear.

_____

_____

_____

_____

_____

_____

ART. XII. The said parties for themselves, their heirs, executors, administrators and assigns, do hereby agree to the full performance of the covenants herein contained.

In Witness Whereof, the parties to these presents have hereunto set their hands and seals, the day and year first above written.

In presence of

_____ SEAL

_____ SEAL

_____ SEAL

_____ SEAL

THE UNIFORM CONTRACT

FORM OF CONTRACT

ADOPTED AND RECOMMENDED FOR GENERAL USE BY THE

AMERICAN INSTITUTE OF ARCHITECTS

AND THE

NATIONAL ASSOCIATION OF BUILDERS

AGREEMENT

BETWEEN

_____ *Contractor*

AND

_____ *Owner*

FOR

_____

AT

_____

_____

DATED

_____ *190*—

ARCHITECTS,

_____

_____

AMOUNT OF CONTRACT,

$_____

FORM 4

CONTRACTOR'S BOND

80. Bonding of Contractor.—In large and important work, the contractor is often required by the owner to furnish a bond to protect him (the owner) against the failure of the contractor to finish the work according to the contract. In case the contractor should become bankrupt before the completion of the work and be compelled to relinquish the contract, the person or corporation who had gone his surety would be compelled either to employ some other contractor to carry out the contract or to hand over to the owner the amount of the bond, which amount would be figured to be sufficient to enable the owner to employ another contractor to finish the building or work. Forms 5, 6, and 7 show the pages of an application blank for such a bond. This is filled out by the contractor or contracting company, as the case may be, and if all is satisfactory and proper, indemnity is offered by the contractor or the company that issues the bond. The bond is issued by the bonding company. A copy of such a document is shown in Forms 8, 9, and 10, and is filled out to show about what is required. Form 11 shows the title, which appears on the outside when the bond is folded.

It will be noticed that this blank is for an incorporated construction company, another bond blank similar in form being used where the principal is an individual.

CONTRACTOR'S APPLICATION
Form 721, 6m-1-29-08
Revised 7-07

SURETY DEPARTMENT
Contract Division

Application No. _____

Bond No. _____

Form of Bond _____

The Colonial Title Guaranty Company

of Boston, Penna.

Applicants must give full and explicit data under the following heads, and must supply copies of Specifications and Contract for filing with this application. When the contract involves construction, plans or drawings must accompany the application, and will be promptly returned after examination of same. As these requirements are essential to the proper preparation of the bond and the Company's judgment of the case, care in complying with requirements will expedite the issuance of the bond.

1 Full name of applicant _____
(individual, firm, or corporation)

2 Business address _____
(street, city, and state)

3 Residence _____
(street, city, and state)

4 Name and title of officers duly authorized to sign contracts and other sealed papers binding upon the company (if incorporate) _____

5 Amount of bond required, $ _____

6 To whom given? Give full name. If to a corporation, give exact corporate title and names of officers required to sign corporate instruments, also the business address of individual, firm, or corporation

7 Nature of contract _____

8 How long must work be kept in repair after completion? _____

9 Contract price _____

10 If contract price is per unit of measure, give also probable total of contract

Total of contract, $ _____

11 Applicants must, whenever possible, furnish names and addresses of other bidders, with amount of their respective bids.

	(Name)	(Address)	(Bid)
(Highest)			
(Lowest)			

12 Date work is to be commenced _____

13 Date work is to be completed _____

14 Penalty for non-completion at above date _____

15 Premium for completion before above date _____

16 Payments _____

17 Percentage reserved from payments until completion _____

18 Have you ever applied for a contract bond to this or any other company? Ans. _____

19 If so, state name of company, the date, and whether accepted or declined. Ans. _____

20 If declined, state reasons _____

21 Mention experience in line of work to be undertaken _____

22 Number of other contracts now on hand _____

23 Amount of each contract _____

24 When will they be completed? _____

25 Name of surety company which issued bond on above _____

26 **STATEMENT OF ASSETS AND LIABILITIES**

Cash in bank		Borrowed or due on stocks, bonds, etc.	
Stocks, bonds, etc., market value		Capital stock paid (if any)	
Real estate (title in applicant's name)		Borrowed or due on real estate	
Parcel No. 1		Parcel No. 1	
" " 2		" " 2	
" " 3		" " 3	
" " 4		" " 4	
Plant consisting of		Encumbrance on plant	
Stock of supplies			
Notes receivable		Notes payable	
Accounts receivable		Accounts payable	
Other assets		Other liabilities	
TOTAL ASSETS		TOTAL LIABILITIES	

27 Amount of liability as endorser or surety for others, $ _____

28 Amount of Employer's Liability Insurance carried (give names of companies). $ _____

29 If a firm, mention individual property holdings, real and personal, not included in above statement, and any encumbrance _____

30 What indemnity do you offer to induce the company to execute this bond? _____

31 **IF A COPARTNERSHIP ANSWER THESE QUESTIONS:**

Names of all individuals composing same. Please write names and addresses plainly.

NAME	POST-OFFICE ADDRESS
Has any member of the firm ever failed in business?	

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IF A CORPORATION ANSWER THESE QUESTIONS:

In what State incorporated _____ When incorporated _____

Principal office _____

Authorized capital _____ Subscribed capital _____ Paid-up capital _____

President _____ Vice-President _____

Secretary _____ Treasurer _____

REFERENCES

NAME	BUSINESS	POST-OFFICE ADDRESS

In consideration of THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA., becoming surety on the bond herein applied for, the undersigned _____ does hereby covenant and agree to pay in advance the premium or fees hereafter agreed upon, *namely*, $ _____ for *bid bond* (the same to be credited on the premium for the contract bond); _____ dollars for the first year thereof and _____ dollars annually thereafter until it shall serve upon said Company at its home office, in the city of Boston, Pennsylvania, competent written evidence of its discharge from such suretyship and all liability by reason thereof; and the undersigned does hereby bind itself, its heirs, executors, administrators, successors, and assigns to indemnify said THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA., against all loss, costs, damages, charges, and expenses, whatever, resulting from any of its acts, default, or neglect that said THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA., may sustain or incur by reason of its having executed said bond or any continuation thereof. And the undersigned does further agree, in the event of its being unable to complete or carry on the aforementioned contract, to assign, and does hereby assign such plant as the undersigned may own, or have upon said work to said THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA. The undersigned hereby further agrees, for itself, its successors, and assigns, to accept the vouchers or other evidence of any loss paid by said THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA., under the aforesaid obligation, together with vouchers or other evidence of payment, of all costs and expenses whatever incurred by said THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA., in adjusting such loss or in completing said contract, as conclusive evidence against it, its heirs, executors, administrators, successors, and assigns of the fact and extent of its liability under said obligation to said THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA.

And the undersigned does further agree in the event of any breach or default on its part in any of the provisions of the contract hereinbefore mentioned, that THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA., as surety upon the aforesaid bond shall be subrogated to all its rights and properties as principal in said contract, and that deferred payments and any and all moneys and properties that may be due and payable to it at the time of such default or that may thereafter become due and payable to it on account of said contract, shall be credited upon any claim that may be made upon THE COLONIAL TITLE GUARANTY COMPANY OF BOSTON, PENNA., under the bond above mentioned.

These covenants shall be binding not only upon the undersigned, jointly and severally, but as well upon the respective heirs, executors, administrators, successors, and assigns.

Dated at _____ this _____ day of _____ 19____

_____
Applicant

_____ By _____
Witness

_____
(*Title if applicant be a corporation*)

STATEMENT OF AGENT

Personal knowledge of applicant, reputed ability and experience _____

Premium agreed upon _____

Impress upon the applicant the necessity of full and explicit answers to the various questions. At time of forwarding to home office, make note of features not covered by replies and supply the information asked for at as early a date as possible. *See that the application is properly signed and the signatures witnessed.* Secure copy of Contract and Specifications for file with this application. *Attention to these various features will insure prompt action.*

SURETY DEPARTMENT
Contract Division

BOND NO. 825

The Colonial Title Guaranty Company

of Boston, Penna.

Know all Men by these Presents:

That The Scranton Construction Company

a corporation organized under the laws of the Commonwealth of Pennsylvania (hereinafter called the Principal), and **The Colonial Title Guaranty Company, of Boston, Penna.**, a corporation created and existing under the laws of the Commonwealth of Pennsylvania, and whose principal office is located in the city of Boston, Commonwealth of Pennsylvania (hereinafter called the Surety), are held and firmly bound unto John Jones

(hereinafter called the Obligee), in the full and just sum of $10,000.00

Ten Thousand Dollars, lawful money of the United States, to the payment of which sum, well and truly to be made, the said Principal binds itself, its successors and assigns, and the said Surety binds itself, its successors and assigns jointly and severally, firmly by these presents.

Signed, sealed and delivered this 1st day of Jan. A. D. 190 6.

Whereas, said Principal has entered into a certain written contract with the Obligee,

to perform the excavation, mason work, carpenter work, and painting necessary for the erection of a single dwelling house in the city of Boston upon lot at the northeast corner of A street and B avenue. All work to be according to drawings and specifications prepared by John A. Adams, Architect, which drawings and specifications are identified by the information given above and by the signatures of the principal and obligee attached thereto. The consideration in the written contract for this work being $20,000.00.

Now, Therefore, The condition of the foregoing obligation is such that if the said Principal shall well and truly indemnify and save harmless the said Obligee from any pecuniary loss resulting from the breach of any of the terms, covenants, and conditions of the said contract on the part of the said Principal to be performed, then this obligation shall be void; otherwise to remain in full force and effect in law: PROVIDED, however, that this bond is issued subject to the following conditions and provisions:

First.—That no liability shall attach to the Surety hereunder unless, in the event of any default on the part of the Principal in the performance of any of the terms, covenants, or conditions of the said contract, the Obligee shall promptly and immediately upon knowledge thereof, and in any event not later than thirty days after the occurrence of such default, deliver to the Surety at its office in the City of Boston, Penna., written notice thereof with a statement of the principal facts showing such default and the date thereof; nor unless the said Obligee shall deliver written notice to the Surety at its office aforesaid before making to the Principal the final payment provided for under the contract herein referred to.

Second.—That in case of such default on the part of the Principal, the Surety shall have the right, if it so desire, to assume and complete or procure the completion of said contract; and in case of such default, the Surety shall be subrogated and entitled to all the rights and properties of the Principal arising out of the said contract and otherwise, including all securities and indemnities theretofore received by the Obligee and all deferred payments, retained percentages and credits, due to the Principal at the time of such default, or to become due thereafter by the terms and dates of the contract

Third.—That in no event shall the Surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action, or other proceeding thereon that is instituted later than the 31st day of December A. D. 1906.

Fourth.—That in no event shall the Surety be liable for any damage resulting from, or for the construction or repair of any work damaged or destroyed by an act of God, or the public enemies, or mobs, or riots, or civil commotion, or by employes leaving the work being done under the said contract on account of so-called "strikes" or labor difficulties.

FORM 9

In Testimony Whereof, the said Principal has caused these presents to be sealed with its corporate seal, attested by the signature of its duly authorized officers, and the said Surety has caused these presents to be sealed with its corporate seal, attested by the signatures of its_____ President and its_____ Secretary the day and year first above written.

Signed, sealed and delivered
in the presence of

John Smith

Albert Jones

John A. Walker
President

Attest: Edward Ames
Secretary

The Colonial Title Guaranty Company of Boston, Penna.

William A. Blank
President

Attest: E. G. Baker
Secretary

FORM 10

No.

The Colonial Title Guaranty Company

OF BOSTON, PENNA.

CONTRACT BOND

$ 14000

ON BEHALF OF

The Scranton Construction Co.

TO

John Jones

Date Jan 18 1906

Expires July 18 1906

FORM 11

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NOTE.—In this Volume, each Section is complete in itself and has a number. This number is printed at the top of every page of the Section in the headline opposite the page number, and to distinguish the Section number from the page number, the Section number is preceded by a section mark (§). In order to find a reference, glance along the inside edges of the headlines until the desired Section number is found, then along the page numbers of that Section until the desired page is found. Thus, to find the reference "Balconies, §48, p70," turn to the Section marked §48, and then to page 70 of that Section.

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